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Various uses of automation in teaching were studied with mentally retarded (IQ 70 to 90) and/or emotionally disturbed (IQ 80 to 90) youth aged 16 to 20. Programed instruction was presented by six audiovisual devices and techniques: the Devereux Model 50 Teaching Aid, the Learn-Ease Teaching Device, the Mast Teaching Machine, the Graflex Audio-Graphic Instructor, the Car Tap Unit, and the A-V-K (Auditory-Visual-Kinesthetic) Unit. Several preliminary field tests were conducted which involved the development of skills in work related areas; another study involved measurement in the kitchen. Later field testing employed units on job responsibilities, tool recognition, telephone use, and home nursing. Data analysis indicated that the automated method was usually more efficient than the conventional and programed lectured methods; the method integrating conventional and automated instruction was most effective; the machine method alone was least effective; autoinstructional aids decreased the amount of time needed to learn; autoinstructional aids produced greater retention; and autoinstructional aids produced group gains, but individual gains varied considerably within each group. (JD)

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AUTOMATION IN VOCATIONAL TRAINING OF THE MENTALLY RETARDED

THE DEVEREUX FOUNDATION
INSTITUTE FOR RESEARCH AND TRAINING

Final Report
VRA 993-P-63

THE DEVEREUX FOUNDATION
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DEVON, PENNSYLVANIA

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AUTOMATION IN VOCATIONAL TRAINING OF THE MENTALLY RETARDED*

FINAL REPORT

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AUTOMATED VOCATIONAL TRAINING
FOR THE MENTALLY RETARDED

VRA 993-P-63

FINAL REPORT

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INTRODUCTION

PART A

GENERAL BACKGROUND - The current emphasis on providing adequate schooling for all children highlights the need for special education, including individual remedial instruction and vocational training for the mentally retarded, the emotionally handicapped, the disadvantaged youth, the "school dropout," and the youthful offender.

The Devereux Foundation, sponsor of The Devereux Schools, a group of residential treatment and rehabilitation centers, has for some time been keenly interested in the application of automated instruction to a special education program. For the past several years, pilot studies at the Pennsylvania branch of The Devereux Schools have explored the development and implementation of automated teaching aids geared to the specific needs of mentally retarded and/or emotionally disturbed children, adolescents and young adults.[1] Preliminary findings tend to support the view reflected by Criswell (1964) at an annual meeting of the American Psychological Association, who pointed out that programmed instruction should be of particular assistance to the handicapped person.

Criswell (1964) advanced the viewpoint that use of programmed teaching devices provide the handicapped client with a ready-made pathway to achievement; "the values ascribed to this type of teaching are those which should be of particular assistance to handicapped persons: immediate feedback, reward without punishment, self pacing of learning, active physical participation." She goes on to point out that the applicability of programmed instruction to the handicapped, "is obvious for persons whose history involves repeated failure, punishment and inability to keep up with a group."

As was noted in the Devereux studies, Criswell indicated that the immediate feedback and opportunity to operate a gadget, such as a lever to advance the machine frames, is also likely to appeal to mental retardates and to those presenting emotional disabilities, who tend to have difficulties in maintaining attention and concentration and "show impatience" with physical inactivity.

Many moderately to mildly retarded persons are able to adapt themselves to the community when given the opportunity. Kennedy (1948) reported a follow-up study of 256 retardates with I.Q.'s between 50 and 75 in a Connecticut community. She compared this group with 129 control subjects of normal intelligence from the same community and found that three-quarters of the retarded population were self-supporting . No significant differences were found between this group and a so-called "normal" I.Q. control group. Other follow-up studies have shown similar results (Baller 1936, Charles 1953.) Whether this trend is continuing or will remain stable is presently a matter of speculation. The effect of the automation and educational revolutions are being felt and more attention must be given to proper preparation and selective placement of the mental retardate. Development of automated techniques for vocational training of the mentally retarded offers many challenging opportunities.

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[1] Smith, E.A., Reinforcement psychology in special education, Devon, Pa., The Devereux Foundation. A presentation prepared for the American Psychological Association Convention, Chicago, 1960.

INTRODUCTION

PART B

HISTORICAL BACKGROUND OF PROGRAMMED INSTRUCTION - During the past several years, the field of automated instruction has explosively expanded and reached into many varied avenues of human life. The ideas necessary to implement what Konoscki (1965) has termed the instructional revolution can be anti-dated as far back as the Socratic method. Educational "drill" machines of various types have been available for many years. Knowledge of the production and availability of such devices was distinctively limited, however, and usually known only to the inventor, his circle of acquaintances and to the patent office.

In the middle 1920's, Sidney Pressey began using and writing about a multiple-choice testing device which gave rapid feedback to the learner. Pressey, presently acknowledged grandfather of programmed instruction, summarized his observations in 1926 by pointing out that teaching of drill material, scoring of objective tests, and informing the student concerning the correctness of his answers might be done by machine. It could also free the teacher from the burden of routine and clerical tasks resulting from such drill exercises and tests. He conceived of the machine as being adjunct to regular classroom instruction rather than a means to an end, in and of itself. The suggested focus was upon using auto-instructional devices in conjunction with regular classroom presentations as well as utilizing test books and home work assignments, etc.

Pressey's 1925 teaching device was simple in design and structure. It was constructed so that a person could respond to a four-choice question in a window by pushing one of four keys adjacent to the choices. If the student was correct, the next questions would appear and so on until an error was made. When this happened, the learner's function was to attempt other answers in succession until he responded correctly. A record was made of student progress to give both himself and the instructor knowledge of results. Pressey's "machine" had two added features: (1) it could be set so that a new question would appear irrespective of student response; (2) a reward device was implemented so that if a student achieved a predesignated goal he would be suitably reinforced with a "candy lozenge" or any of a variety of different rewards.

Since this earlier auto-instructional aid, Pressey has developed several other devices, i.e., a punchboard where students would answer questions by punching a hole in the space provided for the answer he thought was right. If correct, the punch would go straight through a piece of paper, if not, the student knew he was wrong and had to try again. Another teaching device, "Chemo sheet" was used in the same manner. The principle involved checking the chosen answer with a swab. The correct answer would then turn blue, the wrong answer red. Review cards were also developed and used according to Pressey's model.

Several publications discussing the development of auto-instructional devices and studies exploring their utility and effectiveness were reported by Pressey in the literature from 1926 to the present. Very little immediate, direct, or extensive impact was made upon the educational community. This is especially true of publications prior to 1954. Pressey, himself, has implied that this was in part a function of the depression where no funds were available for technological inovations in education, especially when thousands of teachers were unemployed. In short, the time was not right or ready to accept the new instructional revolution.

A second force in programmed instruction is B.F.Skinner. First in the Harvard Education Review in 1954, and later on in Science magazine in 1958, he lent his name to the automated instructional movement through developing and publicizing a system which he termed "linear programming." His article urged educators to view the learning process as a series of small behavioral steps. His proposals were based upon his experimentation with what he popularly labeled, "operant behavior." The operant, in the Skinnerian paradigm is a response which is emitted by the organism as opposed to the elicited response associated with Pavlovian conditioning.

Operant behavior is under voluntary control mediated by the skeletal system and contingent upon higher mental processes. The central theme of the system is that responses can be made more frequent if an appropriate reinforcer follows. The reinforcer in this instance is the knowledge that one is correct. Furthermore, if some responses are reinforced and others are not, (differential reinforcement) the differentially reinforced response will become prepotent. Behavior may be shaped by reinforcing the desired response and gradually raising the criteria for reinforcements by what he terms "successive approximation."

In programming,the material is divided into small graduated steps with later steps dependent upon mastery of the preliminary information. More difficult concepts are slowly introduced until the desired finished product has been approximated or achieved.

Linear programming is an instructional method which is contingent upon student responding and participating in the form of writing in or in constructing answers to questions based upon prior steps or statements (known as frames) in the program. For example:

Peter Piper picked a peck of pickled peppers.

The amount of peppers picked was ______________.

This answer construct form of presentation may, for example, be accomplished by "machine" type devices containing a drum-like object which rotates each frame, and a roll of paper upon which the student may write in his response and which can be compared with the correct answer. In addition to machines, text books have been developed wherein information is broken down and disseminated by frames following a plan similar to that of the machine. As with the machine, the student answers questions and learns the results on the frame or page which follows.

Basic to Skinner's concept of programming is the presentation of materials in such a way that the likelihood of the student answering incorrectly is remote; the steps are arranged to insure a high probability of success. This is accomplished by providing the occasion for correct answers to be emitted through initial use of "prompts" which are gradually removed or "faded" as the program progresses. The student becomes more dependent upon his own discriminative ability in order to master subject knowledge.

A third current force in the area of programming is Norman Crowder's system of "intrinsic programming." This method of instructional presentation is contingent upon four major steps: (1) reading required material; (2) answering multiple-choice questions about the passage; (3) proceding to the next passage if the response is correct; (4) proceding to a review paragraph or series if the response is incorrect.

Crowder's method is also termed "branching" in that the mechanics of the approach requires the student to branch off into, and work additionally, in areas of weakness prior to continuing along the main branch. Crowder's method requires the student to select the correct answer from a multiple-choice series of possibilities as in Pressey's model. Crowder's method has been adapted to both machine and text book use but appears much too difficult for use with a retarded population.

Many recent programming devices and text books have incorporated an eclectic viewpoint in the development and production of instructional materials. The different approaches frequently become integrated within a single program. Presently available programmed material covers such divergent areas as courses in calculus, physics, foreign languages, how to play bridge, how to perform hypnotism, and innumerable others. Until The Devereux Schools experimented with limited programs for the retarded, there were few, if any, programs available for this disability group.

Using Microfilm Reader to Review Literature
and Reports on Programmed Instruction

Research in programmed instruction today is being carried on at such a pace that it would be most difficult if not impossible for any one person to read all incoming reports. Most research continues to be done in academic areas with regular class students, and with workers in industrial settings. A few studies utilizing auto-instructional devices with the mentally retarded, have demonstrated that these teaching aids can add a new and useful dimension in aiding the retardate develop language and arithmetical skills. There is, however, little or at best very limited vocational materials for adequate use with programmed instructional devices for mentally retarded and/or emotionally disturbed adolescents. Little research had previously been done with programmed vocational material for use with this population. In fact, the development of such material is very recent.

Today, more than ever before, it is essential to provide special training for mentally handicapped persons. Stepped-up programs in our school system caused in part by the launching of Russia's Sputnick in 1958, and resulting legislation such as the National Defense Education Act in 1958, have widened the gap between the person with limited abilities and his regular class counterpart. New jobs are constantly being created by automation. These developing positions are requiring more and more extensive training and skill. Positions formally filled by the unskilled are becoming fewer in number.

Several studies have been conducted using programmed instruction with mentally retarded youngsters. Stoturow (1963) has cited fourteen large scale federally supported projects which have dealt with both arithmetical and verbal programmed instruction for the retarded. Arithmetic programs have proven most successful; more positive results were reported in the area of arithmetic than for programs in verbal areas. Stoturow concluded that programmed instruction may be more effective than other approaches presently available for the mentally retarded, particularly in institutional settings. Leith (1963) also working with low I.Q. children, found this population could profit from using programmed materials.

Results are not consistently positive where programmed instruction has been tried with mentally retarded populations. Indeed, investigators have come up with negative results. Blackman and Capobianco (1964) cite both positive and negative findings when programmed instruction was compared with other methods.

In this chapter investigations are reported to offer a picture of present direction and flow of research conducted comparing programmed instruction with other methods of subject matter presentation. Studies are illustrative rather than exhaustive.

During the school year of 1959-1960 Smith and Quakenbush (1960) conducted a programmed learning effectiveness evaluation with twenty-three adolescent mentally retarded students at The Devereux Schools. This group had access to and used the Model 50 Teaching Aid to supplement regular classroom instruction during the school year. The results of the investigation showed that students using the Model 50 showed significant gain in arithmetic using as evaluative criteria the California achievement test, as compared to a group of similar students for the previous year who had been taught by traditional methods. On the basis of their findings, the experimentors concluded that "....teaching aids are useful in promoting academic achievement and better motivation."

A more extensive project was conducted by Smith and Kleiser (1963) in which four classrooms at the Devereux Foundation used the Model 50 with 64 arithmetic programs during an academic year. They found a significant correlation between time spent on the machines and gain in arithmetic scores in addition. Participating teachers expressed the thought that programming materials were a useful adjunct to teaching special class students especially in review work and drill of concepts previously taught.

Maplass and others (1960, 1962, 1964) have been comparing different teaching approaches with mentally retarded children over the past several years. The investigators have been using programs to help the students acquire skill in word recognition, spelling and reading. Both institutionalized and non-institutionalized populations were used. Approaches utilizing two types of teaching aids were employed: keyboard methods, multiple-choice methods. "Human" tutors were compared to machine instruction. Their findings indicate that automated procedures are effective in comparison to other procedures and to human tutors.

A 3,635 frame arithmetic program subdivided into areas of simple counting tasks, addition, subtraction, and signs was developed and tested by Price (1964.) Thirty-six mentally retarded males and females at a residential school served as subjects. Two automated methods of instruction were compared to teaching by a conventional method. With the exception of one machine group which demonstrated superior performance on the subtraction sub-section, results indicated no differences between the groups. Considerable less time, however, was needed for the machine groups to complete the program when compared to the conventional teaching group.

Sprague and Binder (1962) using 15 mentally retarded students as subjects, compared traditional instructional methods with instruction by teacher and machine. They found that although the retardates learned by the machine and "maintained high cooperativeness," no significant differences existed between the two methods of instructi

Machines were found effective for producing increases in written vocabulary at a time savings when compared to conventional methods. The investigator, Ellson (1962) noted that the same results were not true for spoken vocabulary.

Blackman and Capobianco (1964) report on a project on developing and evaluating a curriculum for the Educable Mentally Retarded. With one exception, in area of arithmetic where the machine group showed greater gains than the non-machine group, the investigators report no difference between groups using auto-instructional devices and groups taught by traditional methods. Several mitigating factors such as limited exposure to the machine for automated groups, difficulties with experimental design, and with program materials were discussed.

Eldred (1966) describes a 3-year project at Vermont State Hospital which focused upon remedial instruction, regular subject instruction, and vocational courses comparing automated instruction with programmed texts. Subjects were both emotionally disturbed and/or mentally retarded. The project finding that gain resulting from programmed instruction was initially encouraging. However, students were unable to transfer and apply this information in a practical setting. An important observation was noted that some students seem to do better with one method than with another.

Explorations and investigations in the use of programmed materials with the mentally retarded is an on-going process. Abraham (1966) lists ten studies which are being conducted at present. Shay (1961) working with step size in programming found that educable mentally retarded students could perform well on programs developed for normal learners. This is consistent with Stolurow's (1960) statement that with "....efficient methods of learning, the poorer student is assisted sufficiently so that he becomes in terms of criterion performed, indistinguishable from the more able student." Bruner (1962) has also stated that any child can learn anything if it is presented in an intellectually honest way. Time, however, looms as the critical factor. Anything which would reduce time to learn and facilitate performance of the retardate would be intrinsically worthwhile.

Some special education teachers are beginning to use a "core" approach in attempting to put their students in a competitive position on the job market. Much emphasis has been placed on applying school learning to real life situations. Many teachers have used audio-visual aids, role playing methods, special automated teaching devices, etc. to help enrich the learning environment. A good deal more remains to be done. Because of the large number of mentally handicapped individuals in the population, coupled with demands made by society for higher skill levels, continued research is mandatory if productive assistance is to be offered the intellectually disadvantaged. Auto-instructional vocational programs may prove to be a useful and powerful adjunct in training mentally retarded youth to take their place in the world-of-work.

INTRODUCTION

PART C

PROJECT BACKGROUND - Although the need is great, limited instructional material is available for use in vocational training and rehabilitation of adolescents who are: (a) "slow" learners, but not markedly retarded, and (b) the emotionally handicapped; those with emotional and/or personality disorders, presently severe enough to necessitate their removal from the regular school classroom because of the learning and/or personal adjustment problems they present.

Limitations of Special Education Groups - The first group of students, the "slow" learners, usually cannot read well enough to benefit from most of the currently available vocational material. For example, the mathematics involved in many programs is often far beyond their intellectual limits; examples and illustrations used to emphasize important points during the instruction period are usually unfamiliar to this group and consequently tend to lead to confusion and discouragement, rather than in clarification.

The second group of students, those with emotional disabilities, presents similar learning difficulties. Frequently there is also reflected a concurrent negativistic attitude toward education in general, which adds further complication to the training situation of these "reluctant learners."

These two groups, while different, do seem to present enough common elements so that it would appear feasible to develop vocational training material for both groups concurrently.

Model 50 Teaching Aid Developed - In 1958, Edgar A. Smith, Ed.D., at that time, Senior Educational psychologist at the Pennsylvania branch of The Devereux Schools embarked on a project aimed at developing a simple automated teaching device and accompanying programmed subject material which would be suitable for the instruction of "slow" and "reluctant" learners.

An experimental "teaching machine," which ultimately evolved into the present Devereux Model 50 Teaching Aid (described in Section III), a lightweight, compact, teaching device which utilizes programmed workbooks, was developed during this period and subsequently modified to its present form.

Subject matter workbooks in the areas of reading and arithmetic were also developed by Dr. Smith and members of the Departments of Psychology and Education, for use on the Model 50 Teaching Aid and were utilized on an experimental basis in special education classes at The Devereux Schools and elsewhere.

Early Studies Show Promise - Exploratory studies utilizing this instructional material and the Model 50 with mentally retarded as well as with emotionally disturbed students at the Pennsylvania branch of The Devereux Schools, showed that it had merit for use in special education classes. The findings suggested that both the "slow" learner and the poorly motivated, "reluctant" learner, responded not only favorably to classroom instruction supplemented by automated instructional techniques but also showed more academic gain from the experience than those obtained in the classroom utilizing only the conventional teaching methods.[1]

Later, the National Institute of Mental Health, U.S. Public Health Service, supported, in part, a research project aimed at development of programmed arithmetic materials suitable for use with "slow" learners. A number of programs in various areas and levels of arithmetic were prepared, under this project for use with the Model 50.[2] Field tests of these programs indicated that they had merit for use in the education and training of the slow learner.

SIGNS • SYMBOLS
FRACTION CHAR
ONE WHOLE

Receiving Instruction on Use of the Model 50 Teaching Aid

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[1] Smith, E.A., and Quackenbush, J., Devereux teaching aids employed in presenting elementary mathematics in a special education setting, Psychological Reports, Southern Universities Press, October, 1960.

[2] Catalogue of programmed instructional materials in reading and arithmetic, Devon, Pa., The Devereux Foundation Institute for Research and Training, 1962. (Out of print.)

The Present Project - The current project on development of automated vocational training materials was an outgrowth of the earlier experimentation with automated instruction conducted by Dr. Edgar A. Smith, and his group at The Devereux Schools. It was felt that a coordinated plan of classroom teaching utilizing programmed learning and auto-instructional techniques, offered a dynamic and challenging opportunity for use in vocational education and training of 'teenage special education groups.

The Project Plan: Objectives - In 1962, the Devereux Foundation Institute for Research and Training, with support from the U.S. Vocational Rehabilitation Administration, undertook the project on "Automation in Vocational Training of Mentally Retarded and Emotionally Ill Adolescents" with a two-fold goal:

1. Preparation, development and refinement of programmed vocational training material for use with several easily obtainable automated teaching devices, and
2. Evaluation of the effectiveness of this approach in vocational training of adolescents with moderate intellectual and/or emotional handicaps.

A New Teaching Machine Was not Planned - The project was primarily concerned with the preparation of programmed material in vocational and work-related areas for use with auto-instructional teaching aids that are readily available throughout the country and appear to "hold up" in the classroom. Programming for learning is not yet a clearly defined technique and accordingly, there is much room for thought and development.

There was no plan to design and/or to produce a new "teaching machine" during the course of the project. The intent in the original plan was to concentrate on development of programmed material for use on the Devereux Model 50 Teaching Aid. Also, to explore other auto-instructional media, beside the Model 50, where appropriate. Considerable time and effort went into exploring the contributions that such teaching devices could make to the project taking into consideration the following factors:

1. The "machine" must be portable, easy to carry and usable in any location in the classroom.
2. The initial cost of the teaching device must be reasonable and well within the practical scope of a budget-conscious small school system. It should preferably meet the requirements for purchase under NDEA funds.
3. It should not be a "prototype" piece of equipment and subject to an ever-hanging threat of "obsolescence."
4. The cost of upkeep, service, repair and replacement should be reasonable and readily obtainable without delay, even in rural areas.
5. It should be equipment that is not only readily available but is currently being used by schools and institutions throughout the country and has demonstrated an ability to "hold up" in the classroom, as evidenced by the types of organization making use of them.
6. It should be equipment for which reputable suppliers, i.e., Encyclopedia Britanica, has prepared, or are in process of preparing, programmed instructional materials, so that the teaching devices may have the widest possible use as new materials become available; at the same time, a more flexible use of the equipment may provide an added incentive for authorization to purchase it for the institution.

7. The production of the programmed instructional material for use on the Teaching Aid must be relatively uncomplicated.

8. The Teaching Device should aid in eliciting student responses. Many types of machines were tried unsuccessfully; with "reluctant learners," the presentation of correct responses had to be a simple process; with many, a presentation in written form did not afford sufficient reinforcement to obtain persistent responding.

9. The overall result of using the machine must be an increase in the personal contact between teacher and student; the machine telling the student and only the student that he is right, or wrong; the teacher giving individual assistance when it is necessary.

10. "Reinforcement" of learning must be contingent upon an overt response of the student - he must commit himself to a choice. His correct response should receive an immediate and unambiguous reaction from the machine.

11. These Teaching Devices are eventually to be used in conjunction with other forms of classroom presentation and are to be used primarily when repitition is needed to obtain meaningful reinforcement of learning. Consequently, they must be capable of reviewing material introduced through other means of classroom presentation.

Scope of Planned Program Units - While in overall purpose the project was research-oriented, efforts were heavily concentrated on the development of automated instructional units in pre-vocational training areas related to the "world of work;" i.e., job responsibilities, job finding, banking procedures, explanation of withholding tax,etc., and in some specific vocational areas; i.e., tool recognition, shop measurement, homemaking, home nursing, etc.

The decision to devote considerable time to work-related program materials was heavily influenced by the many requests that were received for such material. All too often it was reported that mental retardates had received vocational training and been provided with adequate selective placements only to lose out, not because they lacked in skills, but because of a lack of basic information and practice that should have been provided prior to or concurrent with the vocational training i.e., making change, understanding job terms, knowing how to use the telephone, etc. Other requests pointed to the need for providing more pre-vocational training in basic and in practical arithmetic and for instructional programs suitable for mentally retarded adolescent girls.

Early Development: Staff Recruitment, Orientation - Considerable effort was expended in: (a) recruiting qualified staff members to serve as programmers; (b) in setting up the required physical facilities; and (c) in exploring specific vocational areas for programming.

Much difficulty was encountered in locating personnel with both the requisite subject familiarity in the vocational training area and also knowledge of programming procedures suitable for the "slow learner." Even when individuals were discovered who possessed this combination of skills, they were usually unable to apply their abilities to the development of programmed instructional units expressly geared to the needs of mentally retarded and/or emotionally disturbed adolescents as covered by this project. Consequently, it was necessary to plan, develop and provide a basic orientation program for training of teachers and other interested and qualified persons to prepare the type of programmed material essential to the project's goals. Upon successful completion of the training program, they were appointed as"programmer associates" and added to the staff on a part-time basis.

Several classroom teachers who received this training later prepared programmed instructional units and staff programmers served them in a consulting capacity. Prime value was placed upon the contributions of experienced educational specialists who worked in consultation with the project staff of programmers and consultants in developing instructional units.

It was planned that during the course of the project efforts would be concentrated on:

1. Adaptation of the Devereux Model 50 Teaching Aid for use with the programmed vocational training material developed in the project.

2. Development and refinement of a series of programmed workbooks in a variety of areas for use on the Model 50 Teaching Aid; this is described in Sections III and XIII.

3. Exploring the possibility of adapting some of the Model 50 workbooks to the format of a self-contained programmed workbook which would not require the use of the Model 50 device. This eventually culminated in the "Learn-Ease" programmed workbook series which are described in Section IV.

4. Exploring other readily available automated instructional devices which could be adapted to this project in addition to the Model 50 Teaching Aid. These are described in Sections III through VIII.

5. Development of supplemental audio-visual instructional materials; i.e., slides, models, and other "props" etc. to further enhance the use of the programmed units

6. Exploring and lining up field settings for experimental use of the programmed instructional materials under development.

7. Evaluation of student populations suitable for use in field testing of the developed materials.

8. Conducting developmental studies and field tests; collection, analysis and evaluation of data, revision and final refinement of instructional materials. Research highlights are summarized in Section IX.

9. Preparing and developing a series of instructional booklets giving helpful suggestions for using the various teaching devices and accompanying instructional materials in the classroom; also, instructions for preparing programs for use on each one of the automated teaching devices in the study. A summary listing of all publications and programmed instructional materials developed during the course of the project is given in Section XIII.

10. Exploring the possibility of interesting industrial concerns and professional organizations to publish the prepared programmed materials and making them available free or at low cost to schools and institutions that serve the mentally retarded and emotionally handicapped.

11. Presentation and distribution of the final project report.

12. Sharing the highlights of the project and the obtained research findings with professional groups through lecture and demonstrations at national conventions, e.g., APA, APGA, AMMD, etc. This is reviewed in Section XIII.

Programmed Instructional Aids Have Many Uses - The programmed workbooks and other automated instructional programs are well suited both for reinforcement of learning by providing practice on material already learned in the classroom, and as an aid to classroom instruction by presenting new concepts for the first time. With a share of these teaching tasks transferred to the "machine," the teacher has more time for another very important aspect of teaching - giving personal attention to the problems and needs of the individual student.

The Teaching Aid itself can be made part of the plan of instruction for each student. The teacher determines what special needs the student will have and selects the programs which, in combination with other forms of instruction, will help meet his particular needs. By utilizing programmed material in this way, instruction can proceed on more than one level or, on more than one topic at the same time, in the same classroom.

Section II gives the highlights of the procedures involved in preparing and developing programmed instructional units for use with the Automated Teaching Devices utilized in the project.

PREPARATION OF PROGRAMMED MATERIALS

The Devereux Model 50 Teaching Aid, because of its ease of operation and upkeep, and the economy afforded in its use was planned to be utilized as the basic source of presentation. However, other teaching devices were considered by the project staff when it appeared that the areas under study could best be presented through an audio-visual presentation using other types of auto-instructional teaching devices along with, or in lieu of, the Model 50 presentation.

Programs have been developed for use with the following five types of auto-instructional devices or techniques which are described in detail in Sections III through VIII:

1. The Devereux Model 50 Teaching Aid - A teaching device which presents programs in workbook form utilizing a multiple-choice format.

2. The Learn-Ease Teaching Device - A slide-mask programmed learning device which utilizes a multiple-choice format in workbook form; an adaptation of the Model 50 Teaching Aid.

3. The Mast Teaching Machine - A photo-optical teaching machine which presents 35mm microfilmed programs on a small self-contained rear-projection screen.

4. The Graflex Audio-Graphic Instructor - A teaching device which utilizes a coordinated taped and slide program for simultaneous audio-visual presentation, onto a rear vision screen.

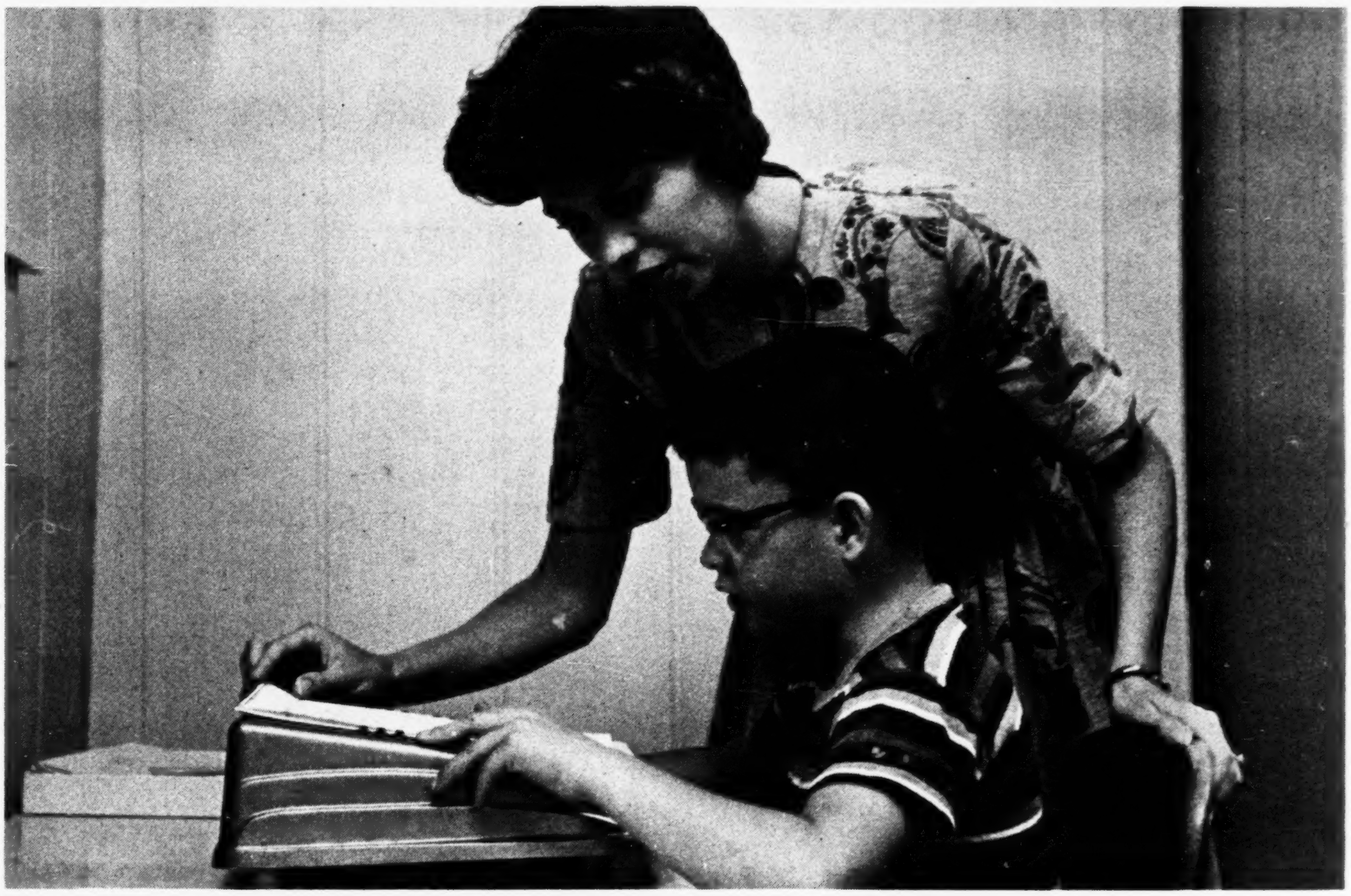
   The Car-Tap Unit - is a teaching device which employs an Eastman Kodak Carousel Slide Projector and a common tape recorder; it is an adaptation of the Graflex programming technique.

5. The A-V-K Unit - An opaque or overhead projector set-up which utilizes a coordinated taped program and makes use of auditory, visual and kinesthetic stimuli.

Two of the described devices, (1) the Car-Tap, which is essentially an adaptation of the programming techniques utilized with the Graflex Teaching Aid; and (2) the A-V-K Unit, should be considered "techniques" rather than specific teaching devices, as such, made up of audio-visual equipment which is easy to obtain and to use.

Research highlights of the field studies utilizing programmed instructional materials developed during the course of the project are given in Sections IX through XI. A complete summary listing of all programmed instructional material and publications prepared in the project, is given in Section XIII. The material in these sections is quite complete, and the publications listed encompass the methodology employed in preparation of the programmed instructional units and in evaluating their effectiveness for use with mentally retarded and emotionally handicapped adolescents, and for this reason the information is not repeated in this section.

The Student Population - The student subjects utilized during the course of the project in development and in field testing of the programmed instructional units developed in this project, are described in the various studies reported in Sections IX through XI. In general, the population encompassed two groups of adolescent



Student Receiving Instruction on Use of Model 50 Teaching Aid

mentally retarded and/or emotionally disturbed boys and girls, ranging in age from 16 to 20 years, who were in residence from 6 to 12 months, at self-contained vocational rehabilitation units of The Devereux Schools in Pennsylvania. None had major physical disabilities or permanently incapacitating emotional disabilities, although they all had failed to make an adjustment in their home communities. They all came from a middle class socio-economic background.

The group of students manifesting emotional problems were relatively low average intelligence in the 80-90 I.Q. range and their emotional problems necessitated their temporary removal from public schools. Most of them had exhibited delinquent or pre-delinquent tendencies which precluded their efficient functioning in their home communities. The student subjects diagnosed as mentally retarded were all slow learners in the 70-90 I.Q. range. Both groups of students for the most part were served by instructional staffs of comparable backgrounds and demonstrated teaching ability.

A comparable group of mentally retarded students was drawn from the vocational and special education classes of several nearby state and private institutions, and from special classes in the local public schools.

Development of Programmed Units - The preparation of programmed instructional materials for use with the mentally retarded and the emotionally handicapped and the evaluation of their effectiveness as teaching aids, is a slow, tedious process. In most instances it was necessary for the staff programmer himself to become familiar with the subject matter under study and/or the performance skill he wished to learn. First, the key points of information had to be broken down into small elements with the programmer noting each bit of information which he learned in the process and the sequence in which it was learned.

All material planned for use in the programmed instructional units were considered in light of the learning potential of the specific group for whom the program is intended; at the same time, consideration of pictures and other graphic material that would be largely self-explanatory are explored.

If a special vocabulary was needed to describe an operation, consideration had to be given to the possibility of teaching this in advance of utilizing it in the programmed unit, unless it could be incorporated into the lesson under study through graphic illustration. Technical terminology was avoided; its use depends upon the objective of the program and the population for whom it is intended.

Linear Programming - The programmed instructional units prepared for the described automated teaching devices follow in general, the Skinner-Pressey techniques of linear programming[1] which is discussed in greater detail in Section 1B and is referred to throughout the report. The lesson material is presented in small sequential steps - there is gradual step-by-step development of a point through the utilization of cueing, repetition and reinforcement.

Preparing Frames for Incremental or Linear Programming - The main characteristic of the step-by-step or incremental method is that it is planned to promote gradual mastery of the subject. The items begin at a very easy level and gradually become more difficult. Eliciting a large number of responses to rather easy items usually proves more effective than attempting to elicit correct responses to a few difficult items.

Gradual Development - The Model 50 program, Linear Measurement: Books I and II, illustrate the use of the step-by-step or incremental method. The first items provide the student with drill and practice in recognizing by sight how long an inch is. Simple straight lines of various lengths are presented and the student is instructed to pick the one that is an inch long. With the exception of a short sentence at the top of each page, the program requires virtually no reading.

It would be expected that the instructor would teach the limited vocabulary used in the program, e.g., words such as "inches," "halves," "quarters," and "lengths," and that the students would have learned the words at least to the point of recognizing them before working through the program. Using an inch as the basic unit measurement, the program proceeds through examples to show how the basic unit may be divided into smaller parts and how these parts are represented on a ruler. Later lessons proceed gradually on to larger units of measurement, beyond the basic unit of one inch. A sample of a more difficult page taken from the program on Linear Measurement is presented on the next page.

Alternative Response - The position of the correct response in the group of three answers may be significant. It is not good practice to have the alternatives in a

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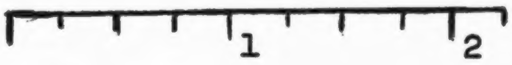
[1] Smith, E.A., Reinforcement psychology in special education, Devon, Pa., The Devereux Foundation. A presentation prepared for the American Psychological Association Convention, Chicago, 1960.

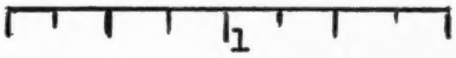
Sample Page

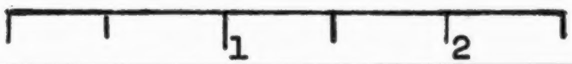
LINEAR MEASUREMENT

Turn Knob
to Number 9 →

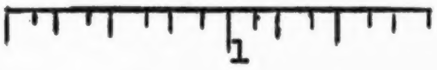
Which is 2¼" long?

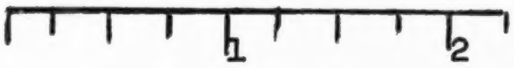


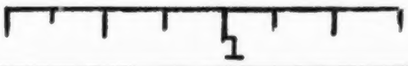




Which is 1 7/8" long?







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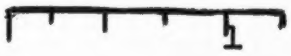
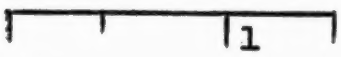
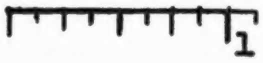
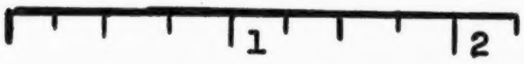
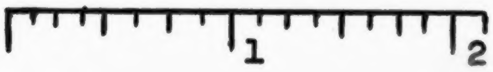


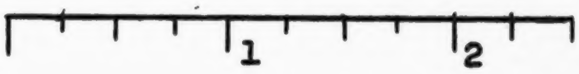




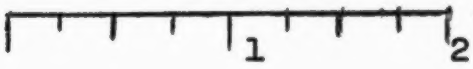
Which is 2½" long?

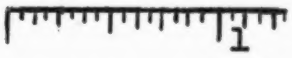


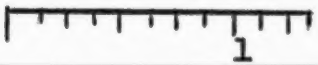




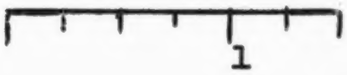
Which is 1 3/8" long?

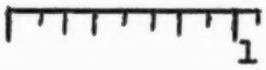


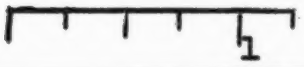




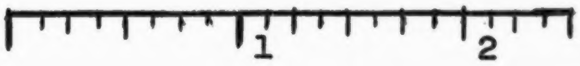
Which is 1¼" long?

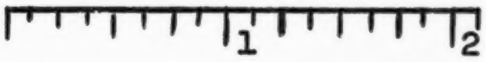


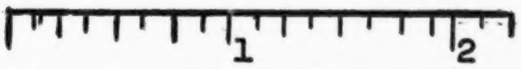




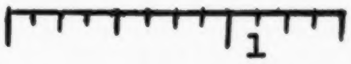
Which is 2 1/8" long?

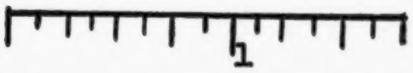


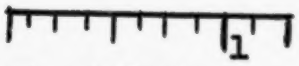




Which is 1 3/4" long?







Turn Page and Reset Knob

random order requiring the student to search. For example, in the item, "If you had nine pencils and lost five, how many would you have left?", it may be well to have the answers listed in descending order. If the answers are a, b, or c, it is usually desirable to present the alternatives in that order rather than c, a, b.

Programmed Units Complement Teaching Methods - The programmed instructional units developed during the course of the project for use on the Model 50 Teaching Aid and for the other auto-instructional teaching devices that were utilized, are intended to complement regular teaching methods and not to replace them. They are useful as an introduction to a unit of study or for practice to stabilize concepts already covered in the classroom.

The programs that have been developed are planned to serve as self-contained units which present and develop a concept as well as to provide practice for reinforcement of learning. Whenever possible, opportunities for additional manipulative activity are provided to the student which help to enrich the learning process. Most retardates respond best to a coordinated plan of teacher instruction concurrent with the opportunity for programmed learning; they enjoy and need the interest of the teacher.

Concept Formation - It has been noted that concept development is facilitated by presenting examples of the concept under study in a simple, step-by-step or incremental method. For example, in the sample Model 50 Workbook page on "Circle and Squares," whic appears on the next page, choosing of the eight successive circles of different size, with immediate reinforcement given for the correct response, may help to stabilize the concept, "circle."

Following the development of a concept, a practicum session would serve to enhance, enrich and consolidate the acquired information and help to improve skills. Later on, an understanding of the concept "circle" will be helpful, for example, in understanding about "round" brushes in a unit on house painting.

To cite another example, in a programmed unit on jobs in a laundry, one unit might cover "folding a bed sheet" which would include sufficient instruction and actual practice to get across the concept of "folding," "packing," etc. Greater proficiency in this task could then be developed through additional practice to reinforce learning acquired through the program.

Student Reading Level - Before writing items or "frames" for a programmed workbook, the reading level of the student population must be considered. The amount of learning may be influenced by the readability level of the material. The reading level must also be taken into consideration when determining the optimum step length of the workbook pages. For students with reading difficulties, short frames are more effective than longer more complex ones. Graphic illustrations should also be considered.

Readability Index - A significant problem encountered in developing programmed instructional materials is that of keeping the level of vocabulary commensurate with the content material of the instructional unit. The amount of learning may be influenced by the readability level of the material. For example, a teacher in a special education class noted that on a formal written achievement test, only 1 or 2 out of a group of students correctly answered the question "A quarter is worth_______ nickels." However, when asked the question orally, all of the students gave the correct answer, and in a practical situation, they had little trouble making correct change for a

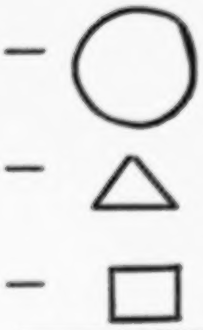
A sample page from the Model 50 Workbook on "Circles and Squares" follows.

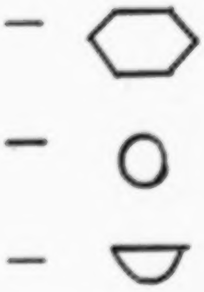
SAMPLE

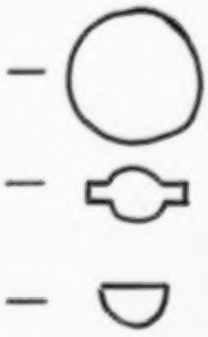
ARITHMETIC VOCABULARY

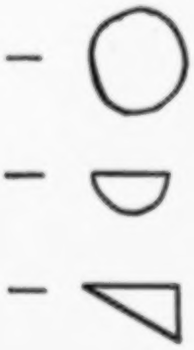
Circles and Squares

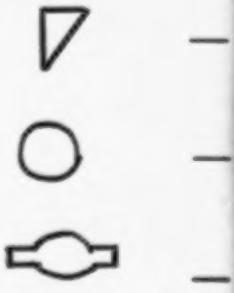
Turn Knob to Number →

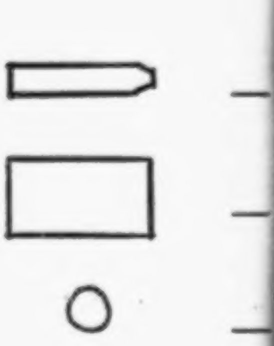


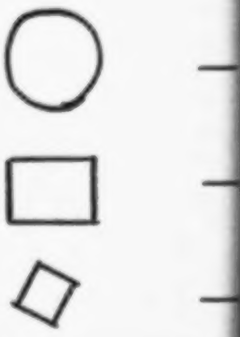


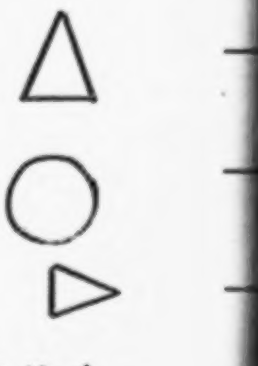












Turn Page and Reset Knob

quarter; the difficulty was that they could not read the word "quarter." A brief definition of an important term followed by several brief, well-chosen examples, will usually be more effective than a lengthy explanation.

The Model 50 programs are geared to the slow learner who functions on a 4th-5th grade reading level and the material prepared for their use is about 51.8, as measured by the Devereux Readability Index, which is about the 4th grade level.

When it is necessary to introduce new words which are not likely to be recognized or understood by the student, these are presented in a manner commensurate with the student's ability to assimilate them. They are carefully defined and explained in simple language using uncomplicated illustrations to clarify the meaning. Reinforcement of the correct answer follows immediately when the student responds correctly. He also has an opportunity for on-the-spot correction of answers which are wrong.

Vocabulary which is above the functioning level of the student tends to introduce anxiety, which is precisely what the Model 50 Teaching Aid and its accompanying workbooks seek to avoid. It is with this interest of creating a tension-free atmosphere of study that the Devereux Readability Index[1] was employed in the programming of Model 50 workbooks.[2]

The Readability Index is a measure used to determine the readability characteristics of a book. It is employed to analyze the word difficulty in a reading text and utilizes two formulas: (1) a formula for determining the readability level, and (2) a formula for translating the readability level into grade level.

Readability is but one factor among many, i.e. interest, reading ability, etc., which must be taken into consideration in preparing programmed instructional materials. It is, nonetheless, important that this sector be considered, especially in terms of vocabulary levels of the reader for whom the program is intended.

Although the Readability Index does not always lend itself for use with short lines or single words it is nevertheless a hand guide to consider in preparing written programmed instructional materials.

Use of Examples - A sample page from the Model 50 workbook on "Tool Recognition" follows on the next page. It utilizes only four words - "Find the Open-end Wrench." Having learned the word, "wrench," the student now matches the correct picture with the name of the tool. The basic format of the "tool recognition" program can be used to provide drill and practice in associating to a variety of objects with the names of tools under study.

Results of a field study utilizing the Model 50 workbooks on "Tool Recognition" are given in Section X.

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[1] Smith, Edgar A., Devereux Readability Index, Journal of Educational Research, Volume 54, Number 8, April 1961.

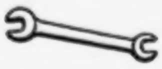
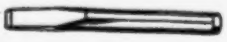
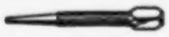
[2] For an extensive discussion of the development of programmed workbooks the reader is referred to the Instruction Booklet, Preparing Programs for the Model 50 Devereux Teaching Aid, Devon, Pa., The Devereux Foundation, 1965.

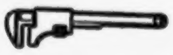
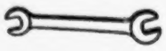
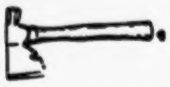
Sample Page

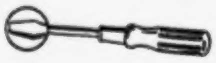
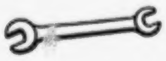
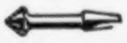
TOOL RECOGNITION

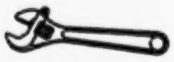
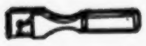
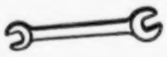
Set Dial to Number 1 →

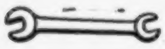
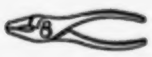
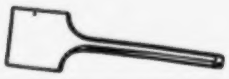
Find the Open End Wrench

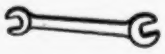
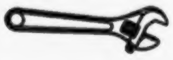
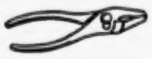




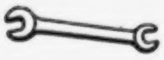
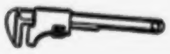
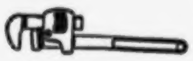




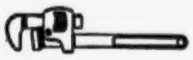
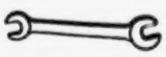
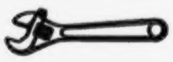




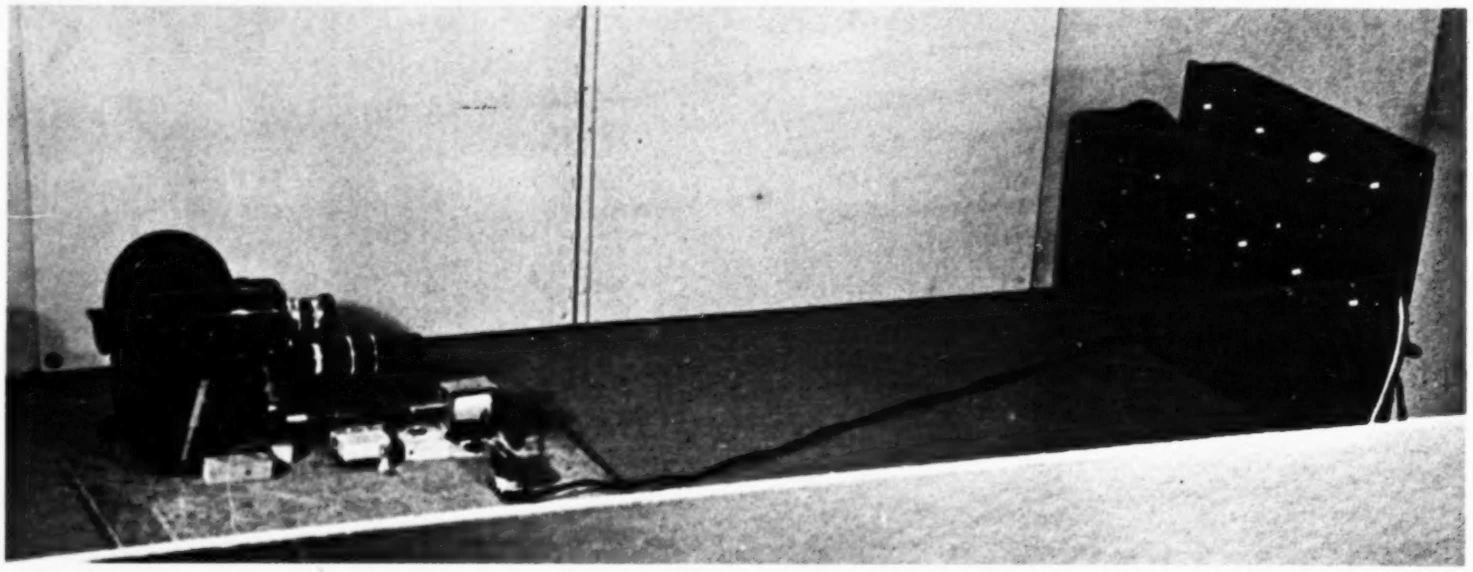




Turn Page and Reset Dial

The Model 50 Response Recorder - In a programmed instructional program for mentally retarded and emotionally disturbed adolescents, it is desirable for the student not to encounter items at the start of the program which might create undue frustration and anxiety. It is also hoped that the student learn to eventually answer all items in the unit correctly. As part of an effort to continually improve the Model 50 instructional programs, a complete item analysis of each frame in given programs was completed.

The purpose of this item analysis was to identify frames whose difficulty level was too advanced for the early sections of a program and to arrange the items in an appropriate sequence: (1) one which will lead the student gradually from the easiest to the most difficult of items; (2) to eliminate ambiguous items; and (3) to eliminate those items which might tend to bring frustration to the student.

Since the Devereux Model 50 Teaching Aid does not have a response-recorder, special equipment was constructed to record the student responses to a programmed workbook unit. A picture of the equipment is shown below.



The basic components of the Model 50 Response Recorder are the camera, elapsed time clock and display panel shown above.

The response recorder has three major components:

1. A remote display panel with indicator lamps tied to each response button on the Model 50 Teaching Device. This panel indicates when a correct response is given.

2. An elapsed time clock which indicates: (a) the time elapsed for each response to a given item; and (b) the total time spent per item.

3. Recording equipment consisting of a single frame-activated 16mm motion picture camera which photographs the display panel and clock each time a response is made on the Model 50 Teaching Aid. Approximately 4,000 responses can be recorded on a one-hundred foot rool of film. This film is viewed for item-analysis purposes via a standard 16mm film editor.

As the Student Selects an Alternative on the Model 50, the Corresponding Lamp on the Display Panel Lights Up Simultaneously and the Camera Photographs the Panel and the Clock.

The data is recorded on 16mm film and is analyzed to observe:

1. Pattern of Response - whether the correct answer for a particular item might be chosen first or last; if chosen first, this might indicate a somewhat frustrating item.

2. Response Time Interval - the amount of time elapsing before a correct answer is given; a longer interval may indicate anxiety.

3. Sequence of Correct Answers - ideally the student should be able to answer all of the items in the beginning frames correctly.

With this equipment, it was possible to identify frames whose level of difficulty was too advanced for the early sections of a program.

Concerning Student Errors - Every effort was made to keep the student's response errors to a minimum. In working with the programmed lesson units he is provided with immediate knowledge of his results and his errors can be corrected before they become habitual. A pre-test is used to help assess the degree of familiarity which the student has with the subject matter covered in the program before he has had any practice with it using the Teaching Aid.

One simple criterion for the classroom teacher to use in evaluating items in a programmed instructional unit is to consider whether or not they appear to encourage learning. If the Teaching Device indicates that the student has given the expected response and he can proceed to the item which follows, that is usually sufficient . At times, however, it may be more economical to allow an occasional small error than to write 10 or 12 more items explaining a point.

For example, in the sample page of the Model 50 program on "Fractions", the initial covert response to this item by many students may be "2". This error can be prevented by introducing additional items or additional explanation. However, when the student notices that "2" is not one of the alternatives and the teaching aid establishes "4" or "$\frac{1}{4}$" as the expected answer, the error is corrected.

Also, it is expected that some students will not master the material by working through it only one time. Students who make more than one or two errors on one point can always go through the program a second or third time. The teacher, by examining the results, determines which students need to repeat a section of the program.

Evaluating Progress - There is no automatic tabulation of correct or incorrect answers. It is felt that fear of competition, so often noted among the mentally retarded and the emotionally handicapped, would be substantially reduced by utilizing the teaching aid in a way that only the student would know when he is responding correctly to the questions in the workbook. For this reason none of the Automated Teaching Devices employed in the project used "counters."

The teacher may determine how well the student is handling the material through: (1) direct observation of the student and his handling of the programmed instructional material; (2) inspection of the finished product, if the lesson is task oriented, i.e., electronic assembly items; (3) an end-of-lesson test or post-test.

A comparison of the scores on the pre-test and on the post-test provides the teacher with a measure of the effectiveness of the program and does not burden the instructor with a great deal of extra "paper work."

Evaluation of Programmed Material - The evaluation of the prepared programmed instructional materials encompassed two major stages during the course of the project:

1. Developmental Testing - Refinement of the prepared programmed instructional units.

2. Field Testing - Evaluating the effectiveness of the prepared programmed instructional materials with the population under study. Preliminary field testing was followed by more intensive field tests utilizing the Model 50 Teaching Aid.

Evaluation of the programmed units, an on-going process during the course of their development, was periodically handicapped by unforseen circumstances. To cite an example - it was noted that the size and style of the type originally used in the multilithing of the programmed instructional aids, usually "Great Primer" type, appeared to be an adverse factor. Students seemed to express preference for a smaller style of type and complained that the large type was for "small kids", not for young adults. Others complained that reading material set up in Great Primer type was for

---

A sample page from the Model 50 Programmed Workbook on "Understanding Fractions" follows.

SAMPLE

INTRODUCTION TO FRACTIONS
Meaning and Vocabulary Terms

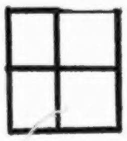
Turn Knob
to Number →

This square is divided into ________equal parts.

— 2

— 3

— 4



Each part is ________.

— one half

— one fourth

— one eigth

One fourth can also be written as ________.

— 1/2

— 1/4

— 1/8

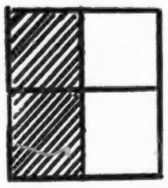
There are ______fourths in one whole.

— 4

— 6

— 8

This square is divided into ___________equal parts.



3 —

4 —

5 —

Each part is __________.

1/3 —

1/4 —

1/5 —

How many fourths are shaded?

Two —

Three —

Four —

How many fourths are not shaded?

Two —

Three —

Four —

Turn Page and Reset Knob

"retarded" kids and not for them. The teachers made similar complaints resulting from their own observations of the student reactions. In the end, fairly large quantities of prepared materials had to be discarded and indicated pages reworked and retyped on multilith masters using the standard conventional pica or elite type.

Developmental Testing for Program Revision - In preparing the programmed instructional units, consideration was given to those frames which more frequently appeared to create difficulty for the student. Perhaps the item needed more detailed explanation or was one that was poorly constructed. Developmental testing with small groups of students was helpful in preparing material for revision.

The teachers were instructed to observe and note any difficulties that the students appeared to have with any parts of the automated instructional programmed units. When a student complained about a particular frame, the teacher marked down the title of the workbook, the page number and the number of the troublesome frame. Then, as specifically as possible, the student was encouraged to describe the difficulty. For example, in the Telephone program, a student may be critical of frame 3 on page 2 of workbook IV. After writing down this reference, the teacher would also jot down any comments he added, i.e., "I don't understand the word, "dial-tone." This is more comprehensive and meaningful than stating simply that the student could not understand the frame. In many instances the student had to be encouraged to be more specific.

This simple method of obtaining information for item analysis is much more economical than performing a frequency count of a large number of responses. The information obtained directly from the student may be superior to that obtained from a frequency count since the student will pinpoint the specific difficulty in the frame. The procedure is relatively uncomplicated and attractive to unsophisticated teachers who may feel threatened by and withdrawn from participating in more involved experimental procedures. This procedure is also one they may attempt to develop in line with their own interests in integrating programmed instruction in their classroom.

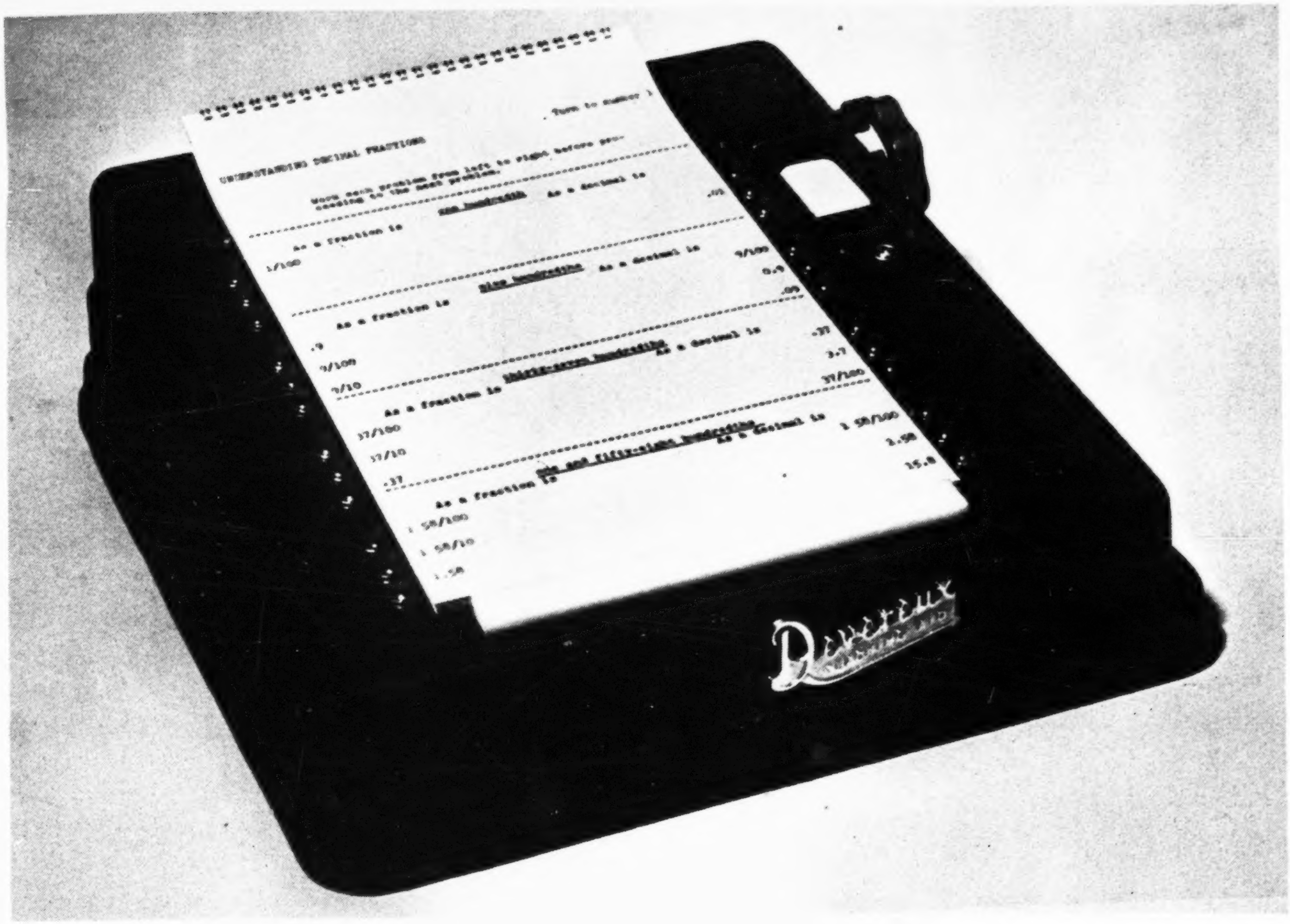
Based on the findings obtained in the developmental testing, the revision varied, for example, from changing only a few items to rewriting pages or even an entire workbook in the Model 50 programs. Reporting as described above, although brief, was found to be invaluable in improvement of various programmed instructional units during the course of the project.

Instructional Manuals Developed - During the course of the project the need for "Do-It-Yourself" manuals for teachers and others interested in the development and use of automated instruction became evident. It was felt that a series of instructional manuals of this type could make a distinct contribution to the field of special education and vocational training.

Accordingly, two basic pamphlets were prepared to cover each of the major automated instructional devices: (1) a "How to Use" instruction pamphlet planned for use as a guide to making the most effective use of the specific Teaching Device, i.e., "The Model 50 Teaching Aid - Suggestions for Classroom Use;" (2) a "How to Prepare Programs" pamphlet to serve as a step-by-step guide to preparing programmed learning materials for a particular Teaching Aid, i.e., "How to Prepare Programs for the Model 50 Teaching Aid."

A summary listing of all the publications and programmed instructional material for use on the Automated Teaching Aids described in the chapters which follow, appears in Section XIII.

THE DEVEREUX MODEL 50 TEACHING AID

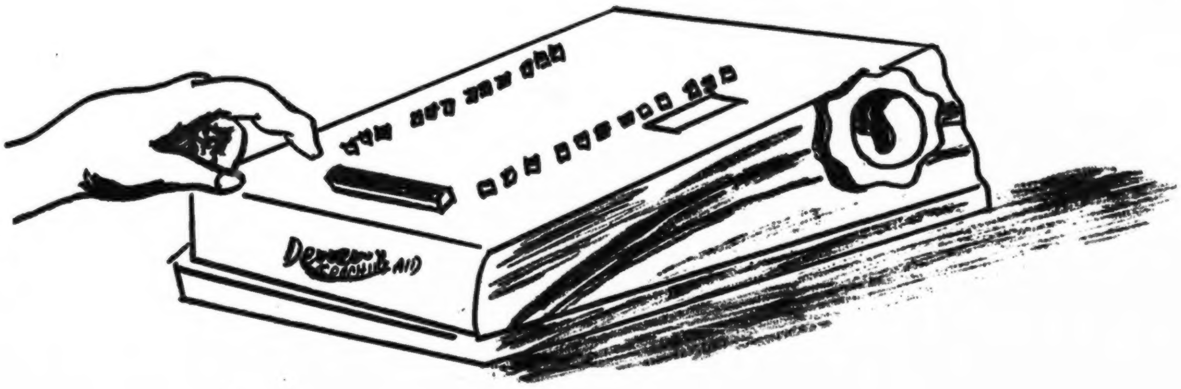


THE MODEL 50 TEACHING AID - The Devereux Model 50 Teaching Aid is a lightweight, compact, easily operated, teaching device which is made of cast aluminum. It measures 12" x 12" x 4", weighs 12 pounds and utilizes a standard six-volt battery as its only source of current. The durability of the Model 50 lies in its simplicity of design and operation. It has held up extremely well in the classroom, requiring little in the way of service and upkeep and seldom requires more than a routine "check up".

The Model 50 was planned particularly for use with the slow learner and is designed so that the amount of reading required to handle some of the subject topics in the programmed lesson units can be limited to a few words per page with greater emphasis given to graphic illustrative material. It may be used with programmed workbooks geared to a variety of intellectual levels.

The Model 50 Teaching Aid is now being produced in the Sheltered Workshop of The Devereux Schools. The cast aluminum body of the Teaching Device is manufactured in a local foundry. All other assembly operations are performed by the students in the workshop under supervision. If there is sufficient interest the Model 50 will continue to be manufactured in the Workshop and made available at low cost to schools and agencies together with a series of instruction pamphlets, giving suggestions for preparing instructional programs in the classroon.

A student in the Sheltered Workshop is shown wiring one of the nine circuits used in the Teaching Device. In addition to wiring of the Model 50, students in the Workshop install the batteries, lamps and the dials which are utilized to select the various response patterns.



Inspection of the newly constructed Model 50 Teaching Aid is a simple procedure and is performed by the workshop students held under supervision. The process is easily learned and the students enjoy the responsibility of testing the finished product and being involved in a system of production and quality control, an on-going process in the workshop.

Workshop Production of Model 50 Workbooks - The collating and binding of most of the Model 50 workbooks and related literature produced during the project was accomplished through Devereux's Sheltered Workshop. This work simultaneously accomplished two goals: (1) it provided dependable and inexpensive service in the preparation of Model 50 books; and (2) it offers students in the Workshop with an opportunity for training and experience in an area which hopefully may be a source of future Workshop contacts. During the course of the project, the Workshop students have become quite expert in the techniques of collating, perforating and binding and the operation was conducted with industrial-like precision.

The large, revolving collating tables, one of which is shown above, were constructed in the Workshop to accommodate the volume production of Model 50 workbooks which require collating and binding. Close supervision is provided by staff members and a system of checks is employed to insure accurate work. As the completed collated books leave the assembly line they are checked for correct page order by students under supervision who are provided with samples of the finished product. After they are checked, the books pass along to the "binders" who preforate the pages and the covers and then they are bound.

The Model 50 Teaching Device is designed for use with multiple-choice response material which is bound in specially prepared programmed workbooks, 7" x 11" in size, each containing 9 to 18 pages. These programmed workbooks contain instructional material which is broken down into small steps and follows the general tenets of the Skinner-Pressey type of linear programming; the material is presented in small sequential steps with a gradual step-by-step development of a point through cueing, repetition, reinforcement and review.

The workbook pages are generally divided into two columns, each containing four items or "frames"; a frame usually includes a question or a statement related to the topic under study and is followed by a listing of three multiple-choice answers, only one of which is correct. The following is a sample from a page in the Model 50 Workbook on "Vocabulary Used in Measuring":

Which tell how much time?

Turn Knob
to Number 4→

— gallons	pints —
— hours	days —
— pounds	tons —

In actual use, the programmed workbook rests on the flat, inclined surface of the Model 50 Teaching Aid. When the workbook is open, its pages lie between two rows of pushbuttons which are arranged in groups of three and correspond to the three multiple-choice answers provided for each of the items on the page.

The Model 50 is wired for nine different response patterns so that the positions of the correct responses on the workbook page can be varied to minimize the opportunity for the student to memorize the pattern of correct responses. If, for example, the correct response to item 2 on every workbook page was always beside the third button, the student might very quickly learn which button to press, but very little else with respect to the lesson content.

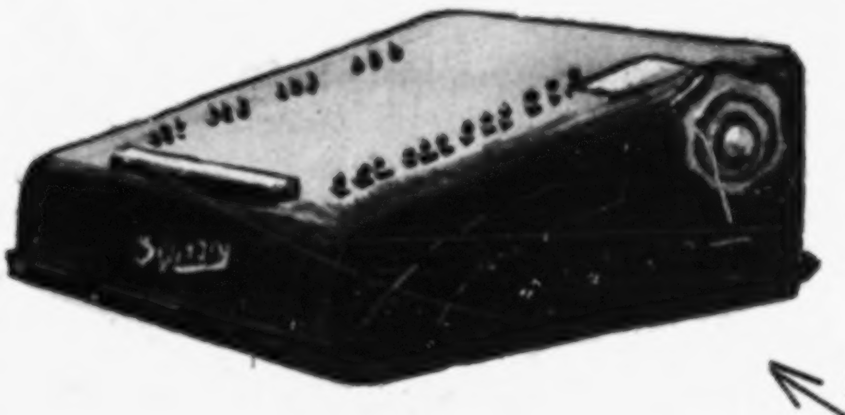
The Model 50 is equipped with a knob which can be set nine ways so that the locations of the correct responses are randomized. The student is instructed, on each workbook page, to turn the knob on the Teaching Device to the specific position number printed in the upper right hand corner of that page. At the bottom of the page, a footnote requests him to turn the page and to reset the knob as instructed on the new page.

The student respons to each question on the workbook page by pushing down the button next to the answer he chooses. Correctness of response is verified immediately; if his selection is correct, a small light goes on in the upper right hand corner of the teaching device. If it is incorrect, no machine response will be given. If sound is preferred in combination with the light, a small switch on the right side of the teaching aid can be adjusted to provide a clicking sound when the light goes on.

A sample of the instruction page which appears in each of the Model 50 programmed workbook follows.

OPERATING INSTRUCTIONS FOR THE DEVEREUX MODEL 50 TEACHING AID

1. Place workbook on Teaching Aid between the two rows of buttons and turn page.



2. Set knob to the number given at the top of the page. Each page of the workbook has a different knob setting. Always be sure that the number set by the knob is the same as the number of the page you are working on.

3. When this slide switch is toward you the light will go on when you press the correct button.

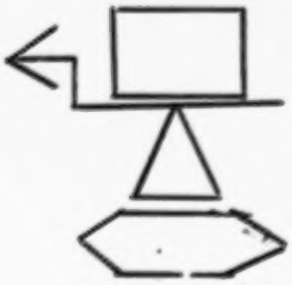
   When the switch is away from you, a buzzer will sound in addition to a light, when you pick the correct answer.

4. Read each question carefully. After you have picked your answer push the button to learn if it is correct.

   Here are two sample items as they might appear in a workbook when you have the knob set at number 1.

SAMPLE ITEMS

Which is the square?



Push this button for correct answer (light or buzzer)

How many are 2 pens and 2 pens?

4 pens →

Push this button for correct answer (light or buzzer)

3 pens

2 pens

Return the knob to 0 (off) when the Teaching Aid is not in use to avoid accidental drain on batteries.

BASIC ARITHMETIC - Many adolescent retardates do not have a working knowledge and understanding of the arithmetic concepts required as background for many types of vocational training. Moreover, they are quite sensitive about this deficiency and will all too often resist vocational activities requiring a working knowledge of basic arithmetic concepts.

A series of programmed units, covering basic arithmetic concepts, previously developed for Devereux students in the elementary grades, have been revised for higher level use and adapted to relate more closely to the vocational training needs of the adolescent population under study.

The Model 50 programmed instructional units in the Basic Arithmetic Series include:

> Understanding Addition and Subtraction - a comprehensive explanation of and practice in the process of addition and subtraction; Understanding Multiplication and Division - the multiplication process and introduction of terms is followed by a systematic presentation of multiplication and division combinations and multiplication of decimals.
>
> Understanding Decimals - step-by-step explanation of carrying, borrowing, and placing the decimal point in addition and subtraction problems; Introduction to Fractions - uses illustrations to convey the concept of parts as they relate to the whole.

PRACTICAL ARITHMETIC - This series of programs is planned to present the practical application of arithmetic knowledge to the various vocational areas related to the world-of-work, in general, and to specific vocational training programs requiring arithmetic knowledge and skills on different levels.

Although many standard arithmetic programs have been published to meet the requirements of most school programs, an appropriate scope and sequence structure needs to be developed so that vocationally oriented arithmetic material can be presented and developed effectively for retarded adolescents; the programs in this series on practical arithmetic include:

> Signs and Symbols - signs, symbols, and abbreviations dealing with arithmetic and with measurement are presented in various contexts; Practice Problems in Adding and Using Money - explains how quantities of money can be represented by numbers and by words; Coins and Making Change-coins and monetary value are represented in various ways and combinations.
>
> Monetary Values - emphasizes difference between relative costs of household furnishings, articles of clothing and food; Budgeting - management, personal earnings and savings; needs in relation to wages, personal budgets and savings accounts.

A sample page taken from the Model 50 programmed workbook on "Understanding Subtraction" follows:

SAMPLE PAGE
FROM
BASIC ARITHMETIC
SERIES

Break these problems into columns.
Find the number that belongs in the box.

Turn Knob to Number 2 →

$\begin{array}{r}4|8\\ \underline{-2|5}\\ |\end{array}$ is done as $\begin{array}{r}4\\ \underline{-2}\end{array}$ and $\begin{array}{r}8\\ \underline{-\square}\end{array}$

— 2

— 4

— 5

$\begin{array}{r}8\ 4\\ \underline{-\square 1}\end{array}$ is done as $\begin{array}{r}8\\ \underline{-2}\end{array}$ and $\begin{array}{r}4\\ \underline{-1}\end{array}$

2 —

4 —

1 —

$\begin{array}{r}7|5\\ \underline{-4|3}\\ |\end{array}$ is done as $\begin{array}{r}7\\ \underline{-\square}\end{array}$ and $\begin{array}{r}5\\ \underline{-3}\end{array}$

— 7

— 5

— 4

$\begin{array}{r}9\square\\ \underline{-5\ 4}\end{array}$ is done as $\begin{array}{r}9\\ \underline{-5}\end{array}$ and $\begin{array}{r}6\\ \underline{-4}\end{array}$

9 —

6 —

5 —

$\begin{array}{r}68\\ \underline{-45}\end{array}$ is done as $\begin{array}{r}6\\ \underline{-4}\end{array}$ and $\begin{array}{r}\square\\ \underline{-5}\end{array}$

— 6

— 8

— 4

$\begin{array}{r}\square\\ \underline{-35}\end{array}$ is done as $\begin{array}{r}5\\ \underline{-3}\end{array}$ and $\begin{array}{r}8\\ \underline{-5}\end{array}$

35 —

38 —

58 —

$\begin{array}{r}59\\ \underline{-27}\end{array}$ is done as $\begin{array}{r}\square\\ \underline{-2}\end{array}$ and $\begin{array}{r}9\\ \underline{-7}\end{array}$

— 9

— 5

— 7

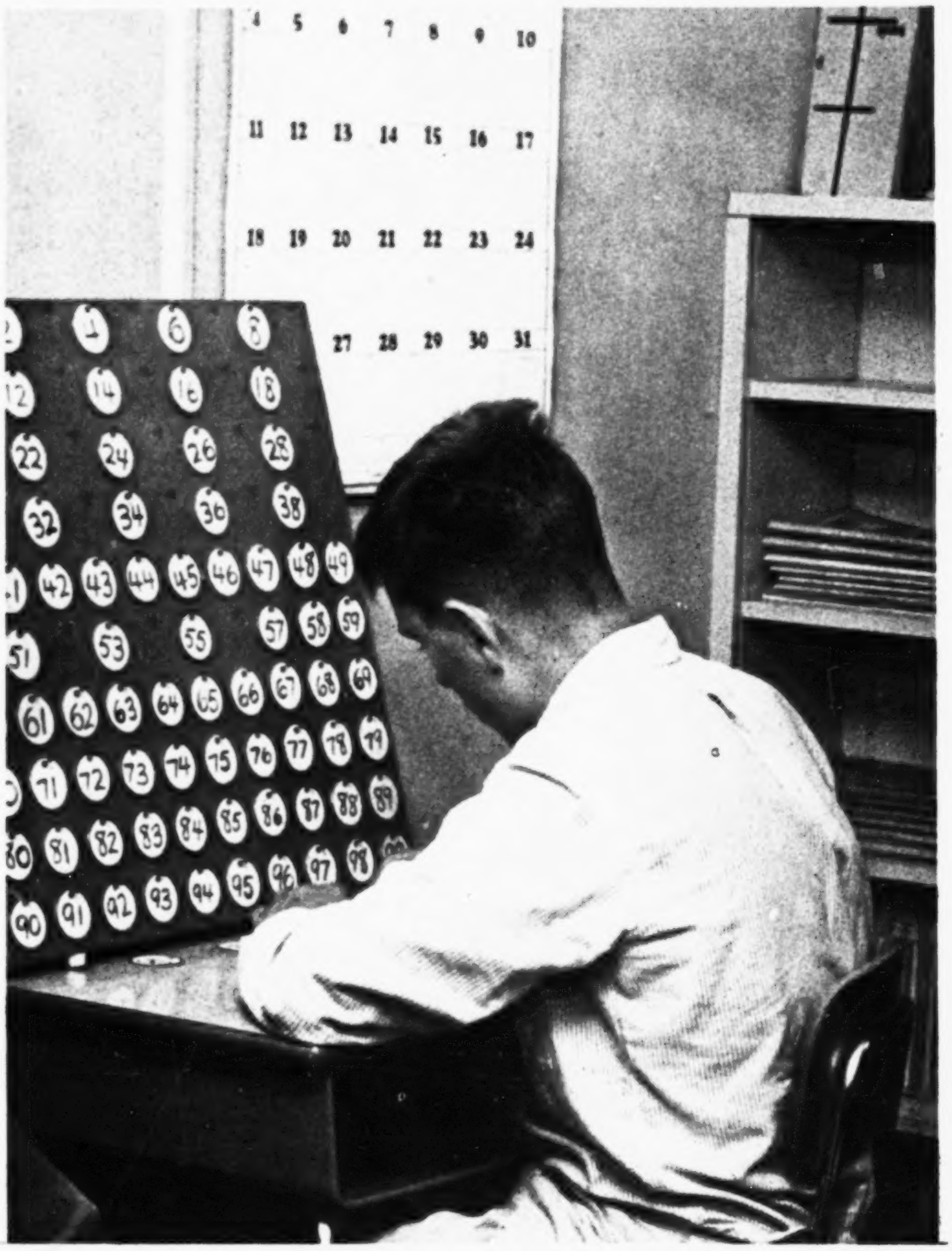
$\begin{array}{r}39\\ \underline{-\square}\end{array}$ is done as $\begin{array}{r}3\\ \underline{-2}\end{array}$ and $\begin{array}{r}9\\ \underline{-4}\end{array}$

24 —

39 —

29 —

Turn Page and Reset Knob



Practicum in Arithmetic Following Instructions on Model 50 Teaching Aid

A common shortcoming of workers in many occupations is their inability to understand measurement. Programmed units have been developed which range from introduction to and review of simple measurement terms, to a review and reinforcement of previously acquired concepts of measurement, relating them to practical occupational tasks. Model 50 programmed instructional units on measurement include:

Vocabulary Used in Measuring-teaches the student to identify terms used in measurement of time, length, quantity and weight; Linear Measurement-provides practice and drill in linear measurement; teaching the use of a ruler in determining lengths of various lines starting with measurements to the nearest inch.

Measurement of Commodities-provides the student with an understanding of how everyday consumer goods are sold; i.e., by the square yard, the pair.

Learning to Tell Time-provides practice in learning how to tell time through a series of clock pictures which have dials set to represent different hours.

A sample page from the programmed workbook on "Learning to Tell Time" follows:

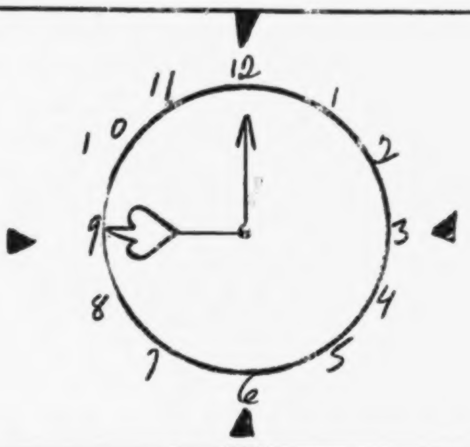
SAMPLE PAGE

LEARNING TO TELL TIME

What time is it?

Turn Knob
to Number →

— 8:00
— 9:00
— 7:00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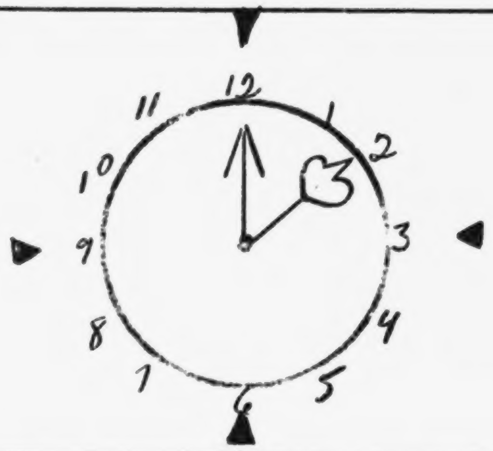
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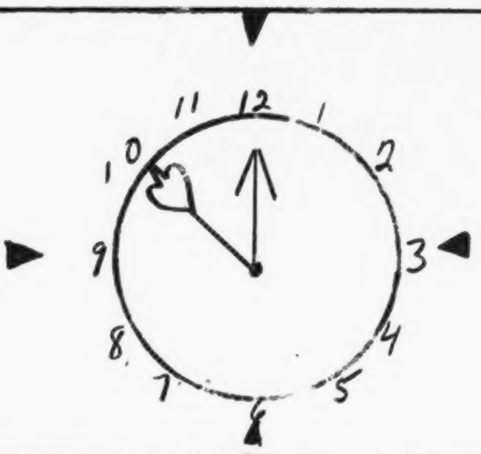
11

1:00 —
3:00 —
2:00 —

— 10:00
— 8:00
— 9:00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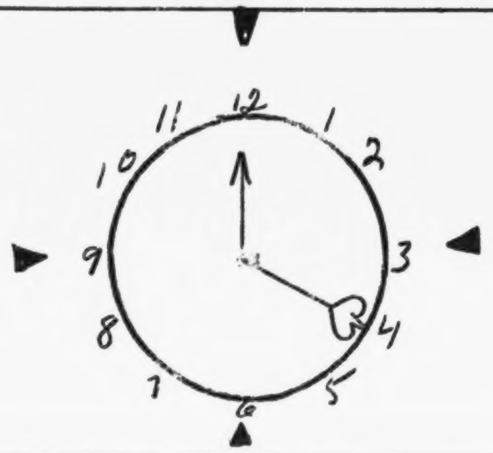
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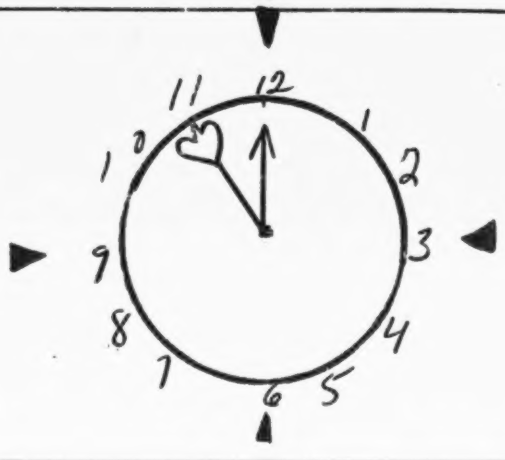
11

4:00 —
6:00 —
12:00 —

— 12:00
— 10:00
— 11:00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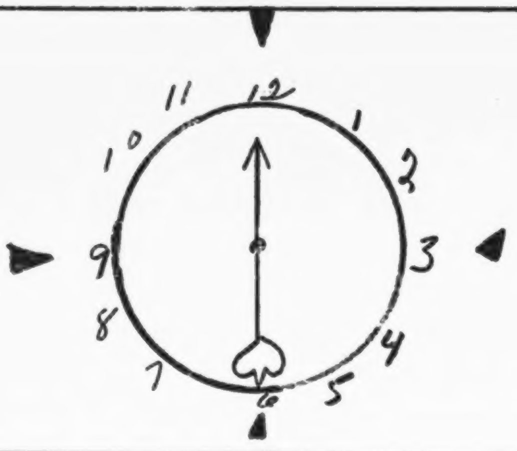
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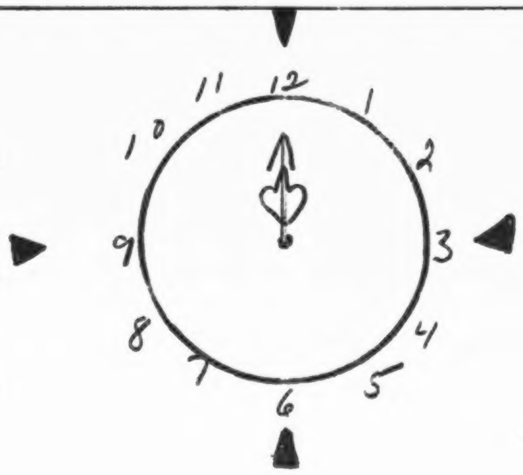
7:00 —
6:00 —
12:00 —

— 11:00
— 10:00
— 12:00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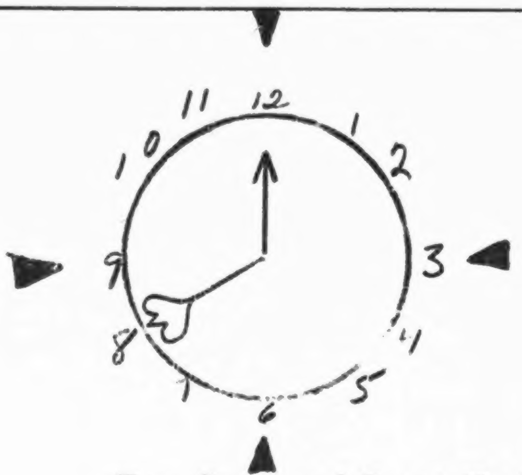
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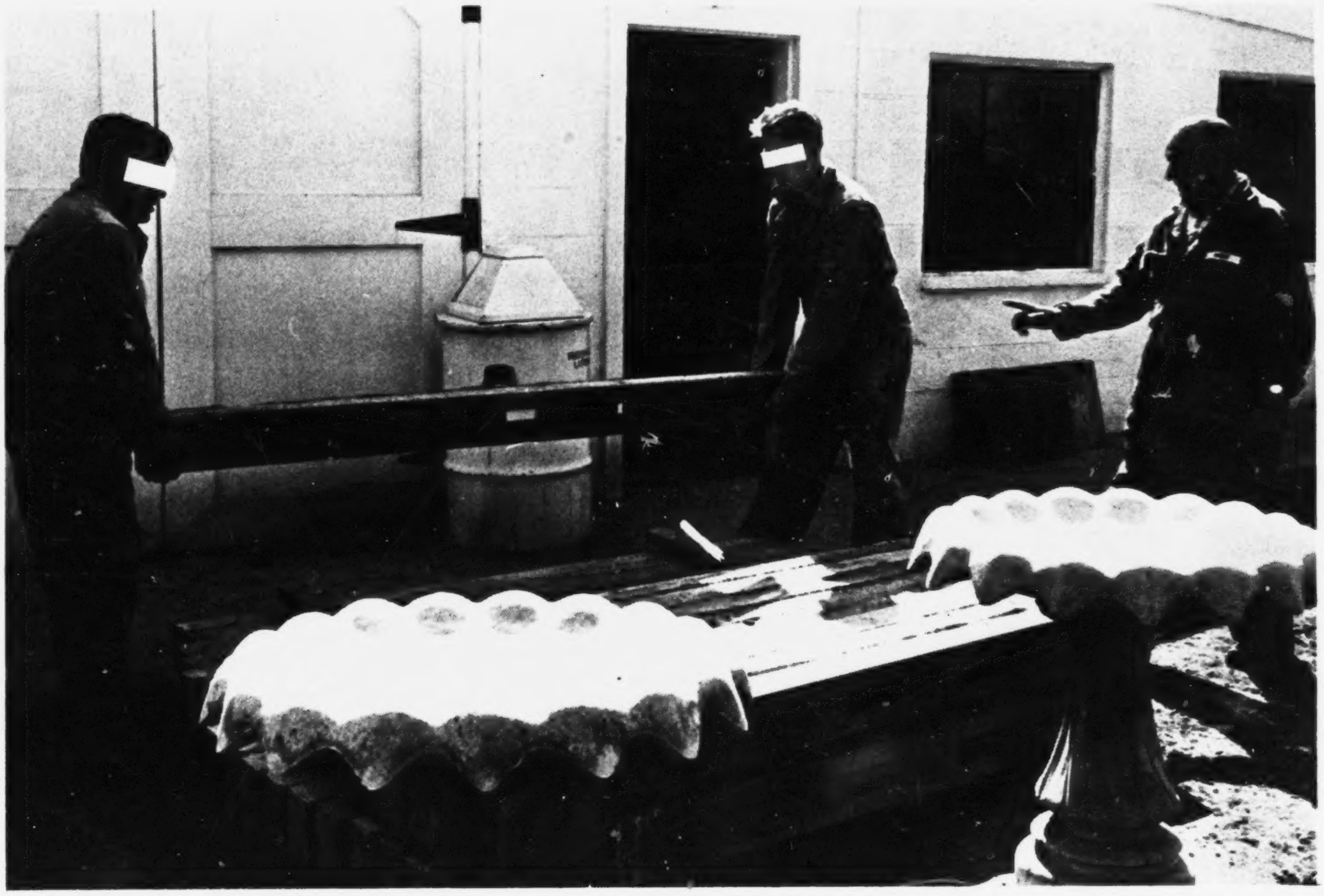
Turn Page and Reset Knob



The Model 50 Programmed Units on Mathematics Provide an Orientation to Practical Application of Basic Arithmetic.

In planning instructional programs, there has been kept in mind the numerous requests for work-related teaching material and a good deal of emphasis has been focused in this direction. A series of work-related programmed units were prepared to help the retardate develop a better knowledge and understanding of the obligations and duties of an employee in industry. Model 50 programs could serve as an orientation to the world-of-work and can help prepare mentally handicapped youth getting ready for employment to become more quickly absorbed as a member of the on-the-job group.

A series of programs have been developed to acquaint the student with the realities of the everyday world-of-work. The units range from simple occupational information to those involving the filling out of employment forms, explanation of wage deductions and other basic employment procedures, all designed to help minimize fear associated with job hunting.

The programs in the World-of-Work series include:

Abbreviations Used in Want Ads-The student becomes familiar with abbreviations found in the "help wanted", classified, sections of the newspapers.

Work Habits-A program designed primarily for manual workers covers importance of keeping tools in good shape, staying on a job until it is finished, etc.

Job Responsibilities - A series of three programmed workbooks planned to help the student learn the common vocabulary used in industry and to understand the working man's language; i.e., full-time and part-time work, "laid off" vs. "fired", as well as to provide information directly related to employment responsibilities. The student learns to apply the acquired information to most employment-seeking situations.

Devereux
TEACHING AID
THE DEVEREUX FOUNDATION

YOU AND YOUR JOB

PART 1 - JOB RESPONSIBILITIES

BOOK I

A Workbook for the Devereux Model 50 Teaching Aid

THE DEVEREUX FOUNDATION
Institute for Research and Training
Devon, Pennsylvania 19333

The Model 50 Workbooks Are Compact and Easy for the Student to Handle

The Bell Telephone Company, through many of its local business offices, provides a "Teletrainer" and practice material on the proper use of the telephone which is accompanied by student workbooks and a teacher's manual and is generally available to schools on a loan basis.

In the photograph below there is portrayed a Teletrainer set-up. The equipment consists of two regular hand-operated dial telephones and a Teletrainer Control Unit. The instructor is explaining how the equipment works to the student. He can adjust controls to create a dial tone, a phone ring, a busy signal, a cut-off, etc. Ordinarily, the two students using the hand-operated phone would, of course, be in separate rooms.

Kinds of calls:
I Personal - Aunt
HOW WE GET HELP

The Teletrainer In Operation

The Teletrainer and accompanying instructional material were used on an exploratory basis in special education classes. Although these showed good potential for use in vocational training, there was, however, a need for less complicated and more refined workbooks and instructional aids to make the material more appropriate for use in vocational training of the mentally retarded.

A series of programmed workbooks have been developed in a coordinated program, utilizing the Model 50 Teaching Aid along with the Teletrainer equipment. The units tell the student what to do on the Teletrainer and when to use it.

The programmed material, in combination with the Teletrainer, emphasizes development of basic performance skills in the courteous and effective use of the telephone and the telephone directory in social and business life; it is not involved in teaching of abstract concepts. The workbook material increases in difficulty as, for example, from lesson units, for the more retarded student, on holding the telephone, to lesson units for the more sophisticated student, on use of the classified directory. The student may skip the parts he knows.

A sample page taken from one of the Model 50 Programmed Workbooks on "How to Use the Telephone" follows.

USING THE TELEPHONE

Sample Page

PICK UP the RECEIVER and hold it correctly

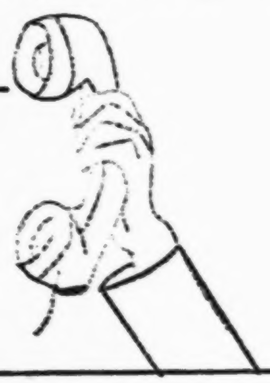
Listen to the listening end. You hear a steady buzzing noise.

This noise is called a DIAL TONE.

Set Knob to Number 4

Pick up the phone and listen. The first thing you hear is the dial tone. It sounds like ______?______.

- — voices
- — a steady buzzing noise
- — bells



The Dial Tone

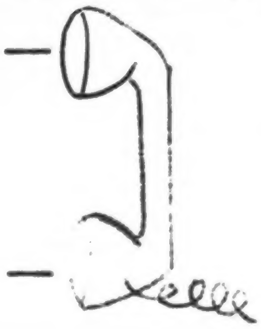
Pick up the phone and listen. The buzzing noise you hear is called ______?______.

- — bells
- — the dial tone
- — a busy signal

The dial tone sounds like ______?______.

- — a busy signal
- — voices
- — a steady buzzing noise

Where do you hear the dial tone?

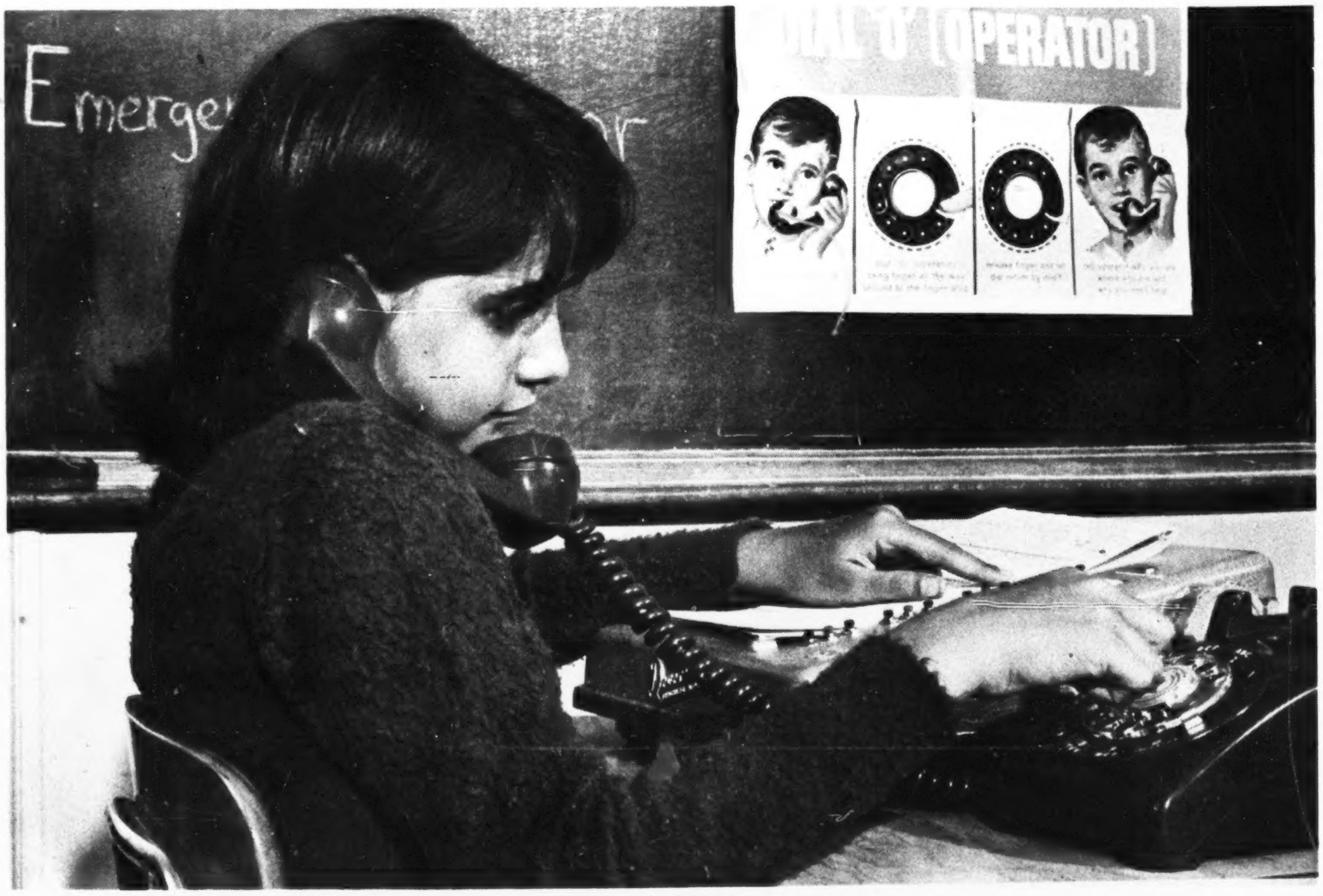


Turn Page and Reset Knob

The full series encompasses ten individual programmed workbooks to give it a greater degree of flexibility and covers:

> Basic Skills - holding the receiver, speaking; Dialing - what is a telephone number, the dial tone, the dial and dialing, the busy signal; Finding the Correct Number - using a personal telephone book, calling the operator, asking for information; Using the Telephone Directory - practice in finding names and telephone numbers in the alphabetical directory, when and how to use the yellow pages of the classified directory; Answering a Call - how to introduce yourself, the friendly call, the business call, the emergency call, the wrong number; Receiving a Call - giving information, taking a message. Some of the units require more than one workbook.

It is hoped that the Telephone Company may in time become interested in making this material available throughout the country to schools and other facilities who wish to use it in combination with the Teletrainer, in vocational training of mentally retarded and/or emotionally handicapped youth.



Coordinating Teletrainer Equipment with the Model 50 Instructional Unit on Using the Telephone.

A programmed unit on "How to Use the Telephone" is also available in the Learn-Ease programs which is described later.

HOMEMAKING AND FAMILY LIVING - Consideration was given to the development of Model 50 programmed instructional units for teenage girls that might be coordinated with the home economics or domestic service curriculum. Programs in homemaking and in related areas include:

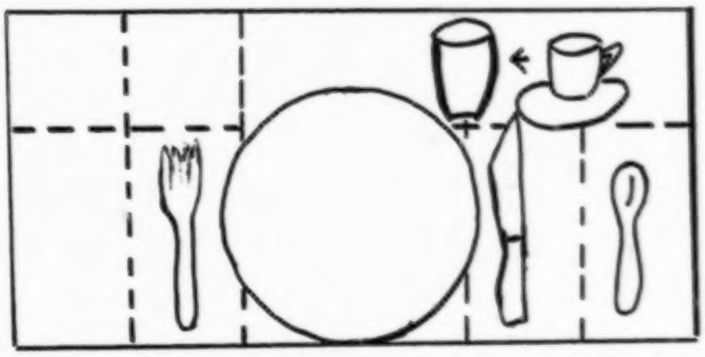
Care of Fabrics - Proper methods of laundering, ironing, and spot cleaning of different kinds of fabrics; reading labels on clothing for better understanding of instructions for laundering; Hand Sewing Tools - How to recognize certain common hand sewing tools and how and when to use them; Sewing on a Button - Simple skills in sewing; become familiar with the sew-through and the shank buttons; step-by-step procedure in sewing on buttons.

Table Setting - Instructions for setting the table before meals: pictorial diagrams show correct placement of breakfast utensils, proper positioning of silverware, glass, cup, napkins, etc.

A sample page from the Model 50 programmed workbook on "Table Setting" follows.

"TABLE SETTING"

SAMPLE PAGE



Turn Knob
to Number 1

Look at the picture above.
Put your finger on the cup and saucer.

Now move your finger to the left until you reach the glass.

The glass is placed to the left of the cup and saucer.

First we find the cup and saucer, then we put the glass to the _______.

— ____

— left

— right

We put the glass to the right of the cup and saucer.

—

correc

fals

We put the glass to the left of the ______________.

— cup and saucer

— fork

— plate

We put the glass on the saucer.

fals

correc

—

We put the glass to the left of the cup and saucer.

— correct

— false

— _____

Would you put the glass to the left of the cup and saucer?

—

ye

n

Turn Page and Reset Knob

Additional programs in the Homemaking series include:

Cleaning the Home - Five workbooks stress orderliness and organization in cleaning the home and discuss proper ways to sweep, dust, vacuum, wax floors and clean windows; Home Safety - Common kitchen and bathroom accidents; how to avoid them; Work Habits in the Kitchen - How to make best use of time in the kitchen; simple safety precautions to help minimize the possibility of accidents in the kitchen.

HOME NURSING - A program based on the American Red Cross Home Nursing was developed for use in training of the slow learner and/or underachieving adolescent girl for employment in such jobs as "mother's helper", or as a practical nurse's aide in institutional settings. The workbooks are planned for use in conjunction with classroom activities, including "live" demonstrations by the instructor, e.g., making a bed. The following is a list of the twelve programs currently available:

Hand Washing - gives information on the hygienic importance of and the proper techniques for hand washing; The Coverall Apron - the coverall apron in the sickroom to prevent the spread of disease germs. Shows the hygienic way of slipping into and out of the apron; The Back Rub - proper technique for giving a back rub; The Bed Bath - steps necessary in bathing the patient who cannot get up from bed. Includes important details such as folding the washcloth into a mitt and washing the face with an "S" motion; Mouth Care - hygienic mouth care for the bedridden patient; Bedmaking - a series of three units covering steps in bed-making of various types; Washing Rubber Gloves - describes standard procedure used in washing and drying rubber gloves; Making the Patient Comfortable in Bed - procedures used in assuring a patient's comfort; Helping the Patient Out of Bed - methods of assisting a patient out of bed; Feeding the Patient - procedures followed in the feeding of bed-patients.

The Model 50 Program series on "Home Nursing" was field tested at one time in a correctional institution using a group of milder retarded adolescent girls, presenting problems of learning and of personal adjustment, who might eventually receive work experience at a local state hospital.

The experimental group received instruction using the American Red Cross course in Home Nursing supplemented by the Model 50 program on this subject. The control group also received instruction from the same teacher; however, it was not given the opportunity to use the Model 50 program. The course covered a ten-week period with a minimum of two hours of instruction per week.

The experimental group showed greater gains. Moreover, hospital work supervisors who observed the subjects of the study in practical work situations, according to establihsed guidelines, reported that the students in the experimental group performed more effectively those work tasks encompassed in the automated program unit.

Other research studies are described later on in the section on Research.

The Home Nursing Course is also available for use on the Learn-Ease, a Teaching Aid described in the next section.

The American Red Cross is keenly interested in this program and will issue an ARC certificate in Home Nursing through its local chapter to those who successfully complete the course, providing it has been taught by an ARC certified instructor.

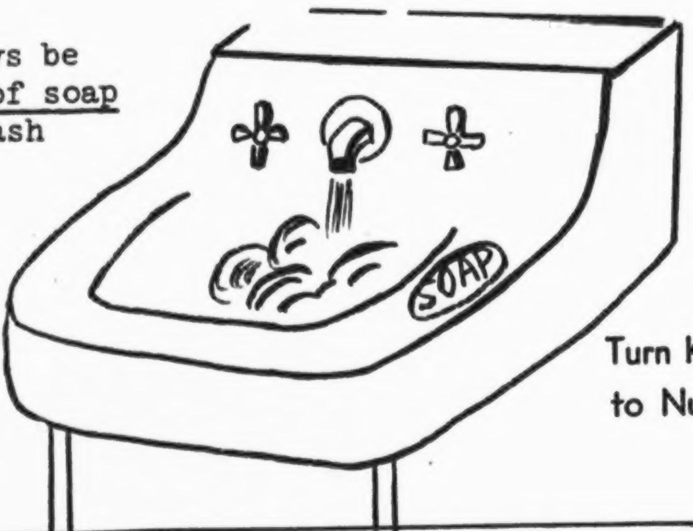
A Practicum Rounds Out the Programmed Instructional Unit on Home Nursing.

A sample page from the Model 50 workbook on "Home Nursing" follows.

Running hot water should always be used for hand washing. A bar of soap loosens the dirt so it will wash away into the sink.

The soap and hot water make a lather which gets rid of dirt and disease germs.

SAMPLE PAGE
HOME NURSING PROGRAM



Turn Knob
to Number 2 →

Two things that are needed for hand washing are hot water and ______.

— disease germs

— clean hands

— a bar of soap

The soap lather gets rid of ______.

— your hands

— the soap

— dirt and disease germs

Running __________ water must be used for hand washing.

— cold

— hot

— warm

What loosens the dirt so it will wash away into the sink?

— the water

— the soap

— your hands

The soap lather gets rid of dirt which may contain__________.

disease germs —

soap —

hot water —

It takes hot water and __________ to make a lather.

disease germs —

soap —

towels —

Soap lather is necessary to remove dirt and make your hands _______.

warm —

dirty —

clean —

The home nurse will need _______ to wash her hands.

hot water and soap—

alcohol—

lotion—

Turn Page and Reset Knob

FOOD FACTS FOR THE KITCHEN - Programmed units designed to help prepare adolescent girls to carry on daily routines of the kitchen include:

Measuring Spoons - Types and uses of teaspoons and tablespoons in food preparation; abbreviations used for both in reading recipes.

Measuring Cups - Used in conjunction with a nest of measuring cups, the student is taught how to identify the different cups, how to measure with them and how to make good use of them in the kitchen.

Cooking Ingredients - Dry and liquid ingredients; i.e., flour, sugar, seasoning, milk, eggs, etc. called for in recipes; Cooking Terms - Three workbooks cover various cooking terms commonly used in recipes such as pare, dice, melt; Reading a Recipe - The parts of a recipe; abbreviations for common cooking terms and measurements; how to read and carry through instructions contained in a recipe.

The Programmed Unit on "Dicing and Cutting" is helpful in Preparation for on-the-job Training in the Food Services.

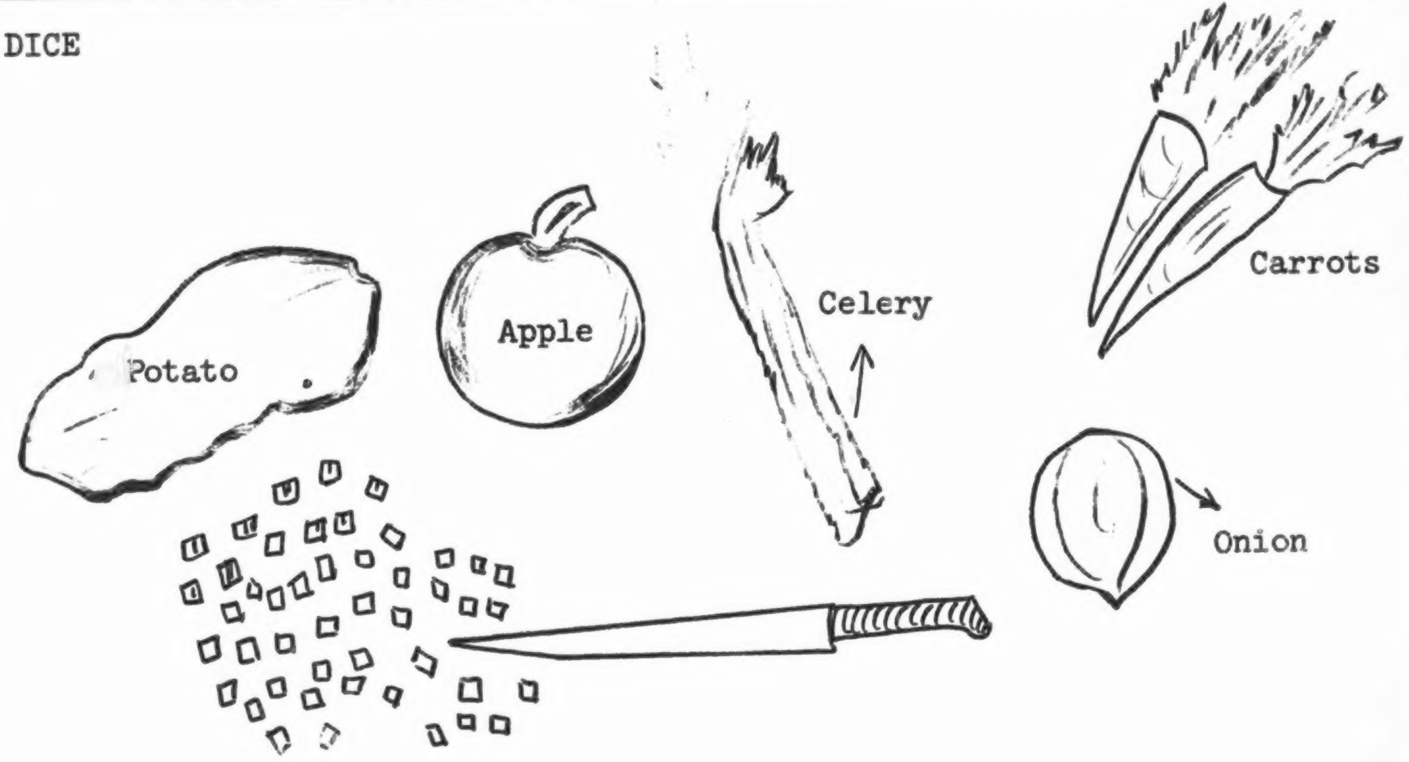
A sample page from the Model 50 Programmed Workbook on "Cooking Terms" follows.

SAMPLE PAGE

To DICE - means to cut foods into small squares.

Turn Knob
to Number 2 →

TO DICE



To dice means to cut foods into small ____________.

— circles

— squares

— triangles

An example of a food that can be diced is a __________.

egg —

milk —

potato —

Cutting foods into small squares is known as __________.

— chopping

— dicing

— mixing

A diced potato will appear in pieces shaped like small__________.

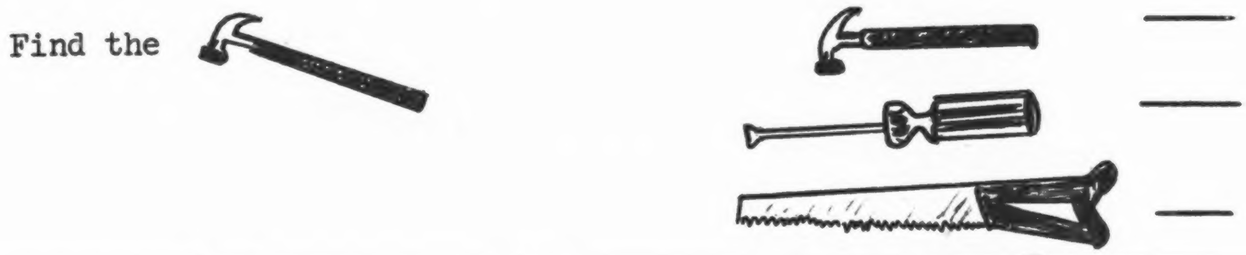
squares —

circles —

balls —

Turn Page and Reset Knob

HAND TOOL RECOGNITION - A group of six workbooks teaches the student to recognize hand tools either by comparison between pictures of tools or between the name of a tool and its picture. The workbooks have been found useful with students in the 50-70 I.Q. range. A sample frame from one of the workbook pages follows:



PROGRAMMED UNIT ON TOWER SYSTEM EVALUATION - For several years Devereux has employed the TOWER System (Testing, Orientation, Work Evaluation in Rehabilitation) which utilizes a group of simulated work tasks constructed to appraise vocational aptitudes and skills of students in various vocational areas in order to obtain a wider perspective of their potentials and readiness for the world-of-work. A TOWER appraisal explores vocational areas which range from the entry occupations requiring little or no training to positions of greater skill for which prerequisite training may be necessary. Job opportunities covered by TOWER tests include: clerical skills, drafting. drawing, electronics assembly, jewelry manufacturing, leather goods, mail clerk, receptionist, sewing machine operator and workshop assembly. A diagnostic appraisal of the student's vocational potential which includes the TOWER System, followed by a plan of automated instruction in the area recommended for vocational exploration, provides a more extensive pre-vocational sampling of various job fields, prior to entering an occupational area.

Experience with TOWER evaluations pointed to the need for more objective test administration to eliminate evaluator bias in the appraisal process. It was felt that the test instructions could be programmed to provide a more objective and standardized evaluation procedure. While TOWER programming for the Model 50 Teaching Aid was adequate for simple work tasks, it was not too useful in covering more complicated procedures, especially for students who have difficulty in visualizing complex operations and for those with reading problems. It was decided to explore the possibility of programming certain TOWER tests utilizing the Graflex Audio-Graphic Instructor (see Section VI; pages 8 through 11). The following Model 50 program was prepared as a pilot instructional unit in the TOWER appraisal:

> **Electronics Assembly** - One of ten Electronics Assembly subtests which provides practice in learning the color code of electrical wires. The program is designed to provide experience preliminary to assignment to a sheltered workshop and/or on-the-job training. The program explains how various types of wires are distinguished from each other by the colored stripes on their coatings. Abbreviations for the colors are also taught.
>
> Example: What color does Vi stand for?
> Violet -
> Yellow -
> White -

A sample page from the Model 50 Workbook on "Electronics Assembly" follows.

Sample page

Instructions for Performing the Electronics Assembly Aptitude Test (TOWER)

Turn Knob to Number 5 →

TEST 1 - "Aptitude in Color Perception and Sorting."

A white-black wire is a white wire with a __?__ stripe.

— black

— green

— red

A white-green wire is a white wire with a __?__ stripe.

— orange

— blue

— green

A white-blue wire is a white wire with a __?__ stripe.

— blue

— red

— green

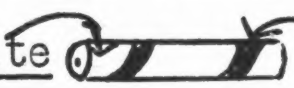
When you are asked to use a wire with two colors, the first color is the color you see most on the wire

— black

— white

— none

Here is our black-white wire again



Which color do you see most on the wire?

Suppose you were told to use a white-green wire. The first color given is White, so the color you would see most on the wire is __?__.

white —

green —

red —

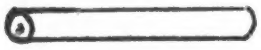
The color that is given __?__ is the one you see most on the wire.

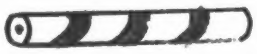
last —

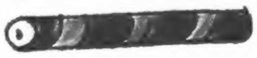
second —

first —

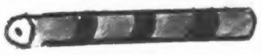
If you had to choose a blue-red wire, which one would you choose?

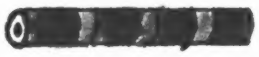
 —

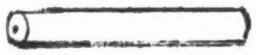
 —

 —

If you had to choose a blue-red wire, which would you choose?

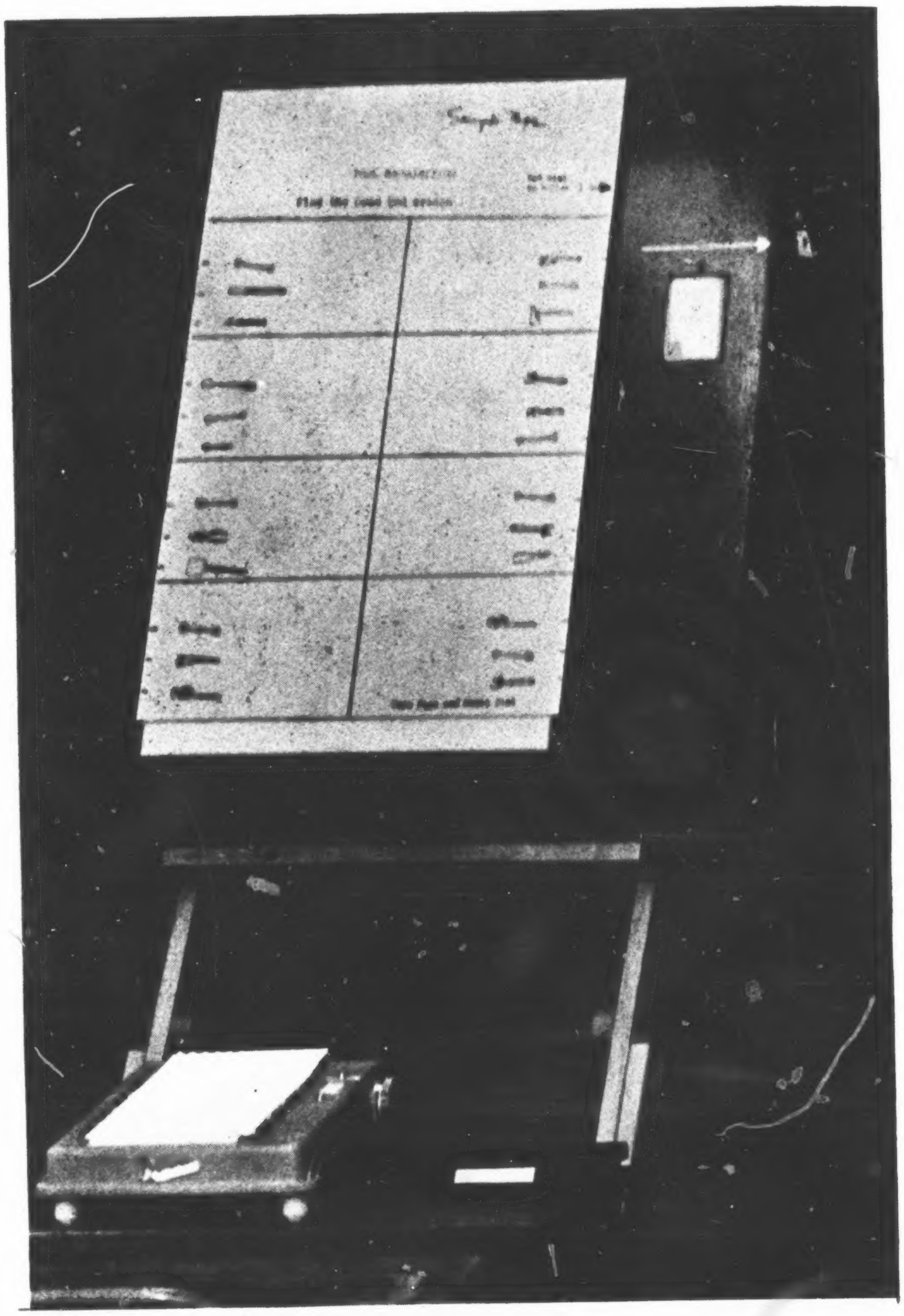
 —

 —

 —

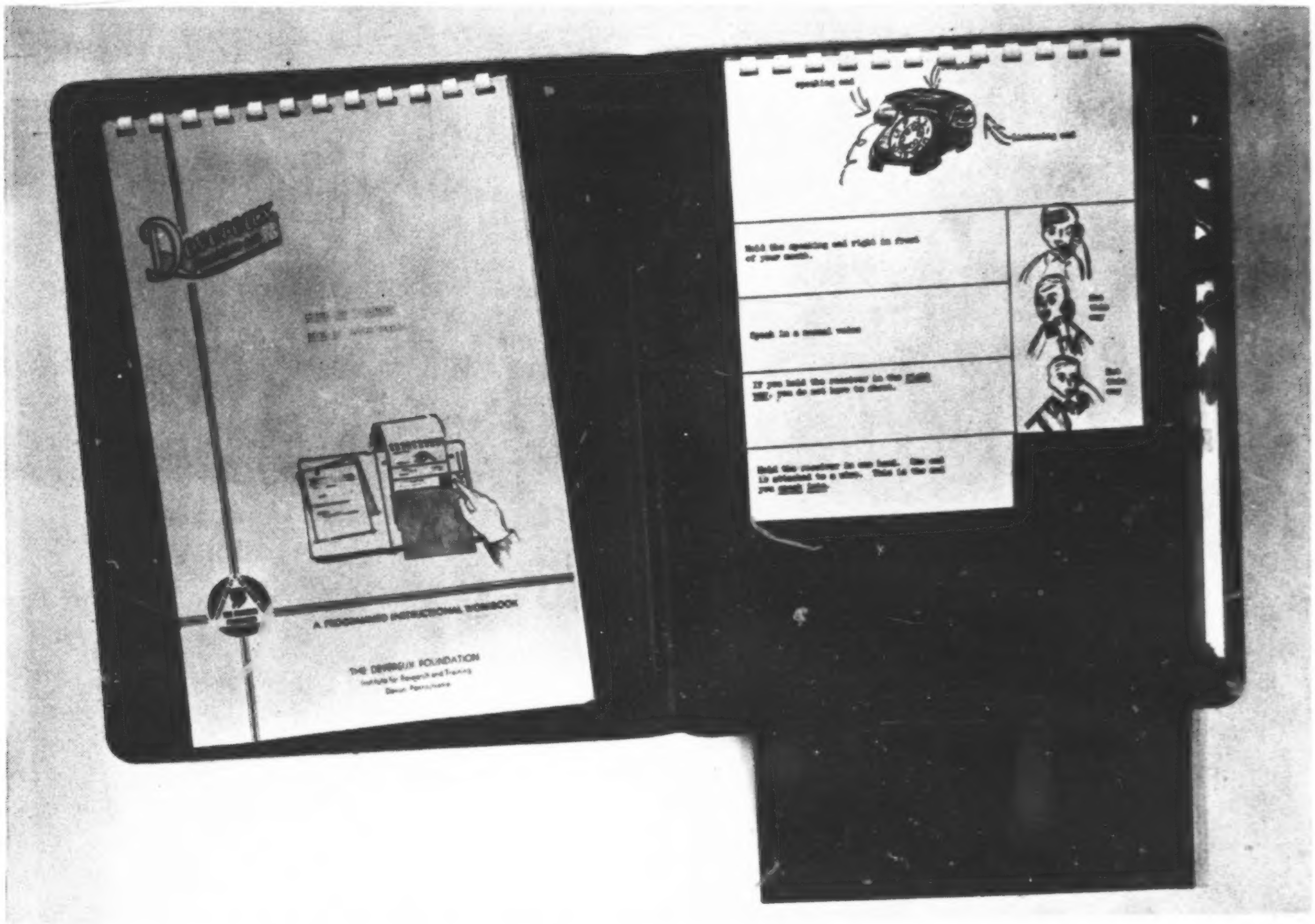
Turn Page and Reset Knob

A large working mock-up of the Devereux Model 50 Teaching Aid shown below, was constructed in the Sheltered Workshop for use at professional meetings in demonstrations related to the Automated Teaching Aids Project.



The mock-up of the Model 50 Teaching Aid is wired similar to the regular size Model 50; its circuits are connected to the corresponding circuits on the smaller model and they work in unison. When a button is pushed on the regular small Model 50, the corresponding button on the larger model is activitated and lights up.

THE LEARN-EASE TEACHING DEVICE

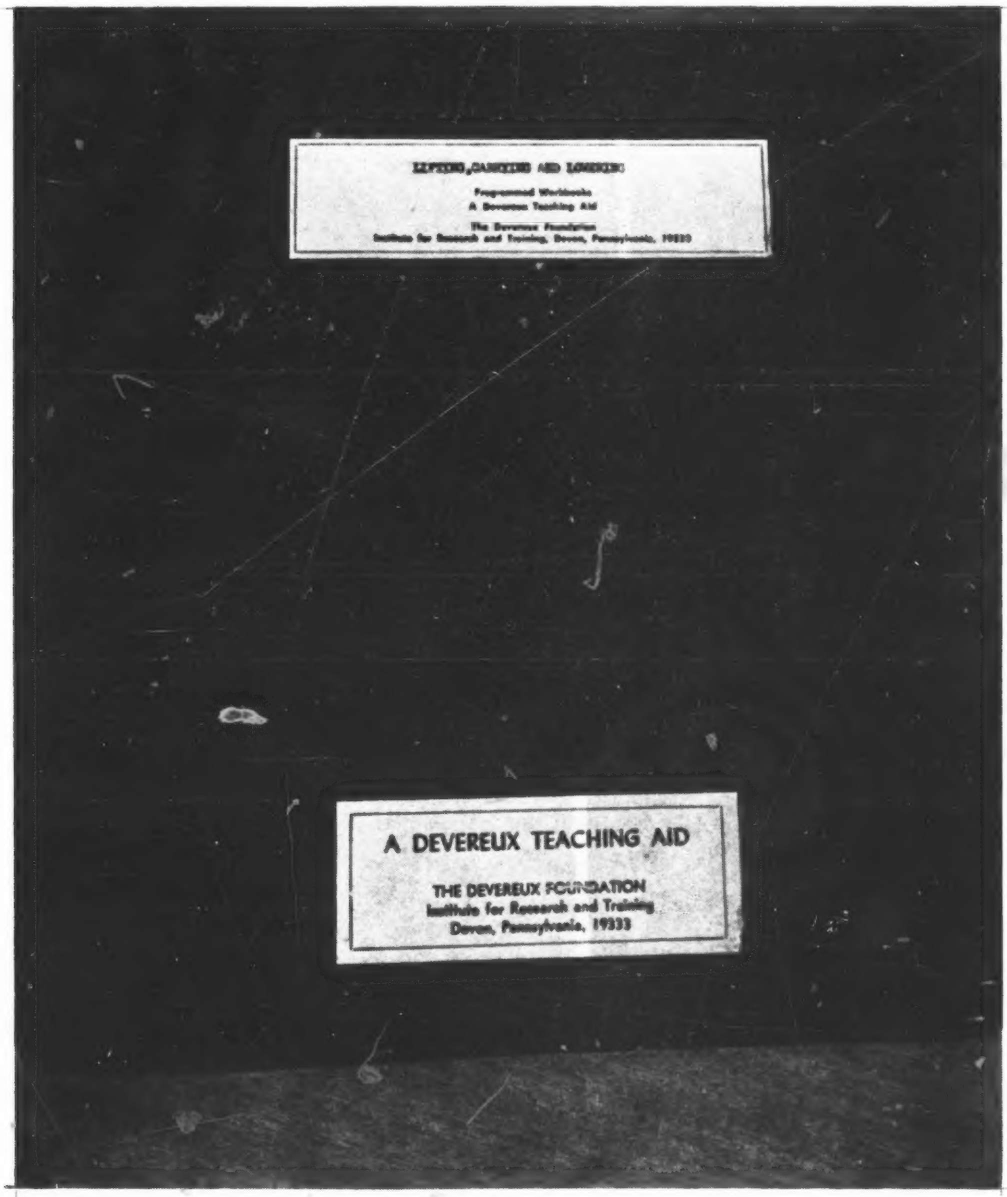

speaking end
listening end
Hold the speaking end right in front of your mouth.
Speak in a normal voice
A PROGRAMMED INSTRUCTIONAL WORKBOOK
THE DEVEREUX FOUNDATION
Institute for Research and Training
Devon, Pennsylvania

THE LEARN-EASE - The Learn-Ease is a programmed learning device which was developed by the National Blank Book Co. and adapted for use in the Devereux project on automated teaching aids. It is essentially an inexpensive 12" x 10" vinyl portfolio which weighs less than two pounds and employs a simple "masking technique". The Learn-Ease is easy to operate and is designed for use with multiple-choice response material published in 7" x 11" programmed workbooks which may be bound either on the side or at the top.

The format of the Learn-Ease programmed workbooks has been adapted from that used with the Devereux Model 50 Teaching Aid. The instructional material contained in both types of workbooks is presented in the Skinner-Pressey style of linear programming; small points of information are introduced in a gradual step-by-step development of learning. However, the Learn-Ease workbooks are self-contained and do not require the use of the Model 50 Teaching Device.

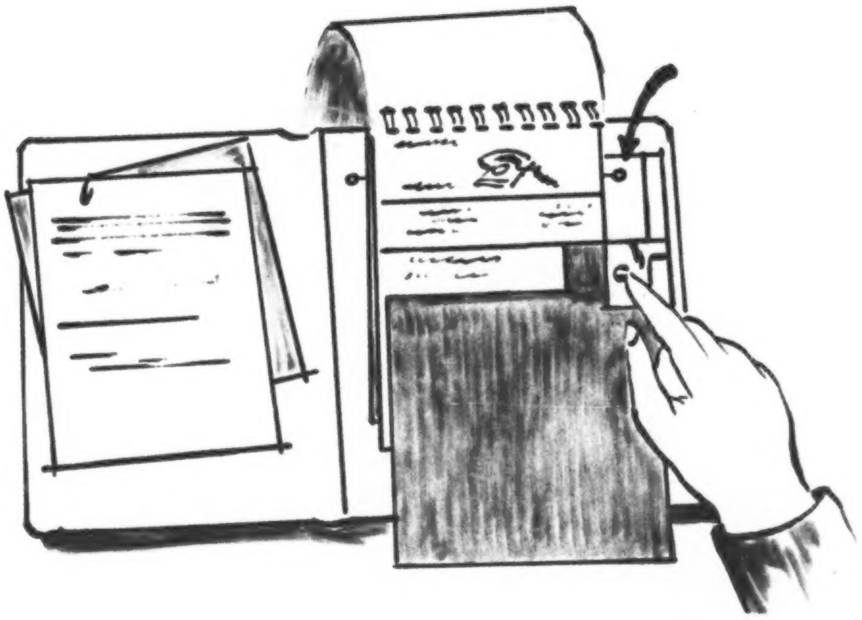
There is a pocket on the left cover of the portfolio where additional programmed workbooks or supplementary materials can be stored. An opening at the top of the right inside cover receives the back cover of the workbook. There is a sliding plastic mask located on the right side of the portfolio which moves on a grooved plastic track. This covers the workbook page and reveals or covers each "frame." A built-in stop prevents the slide-mask from going off either end of the track. The questions appear on the left side of each page; multiple-choice answers are on the right side and are covered by the slide-mask which can be slid down the page. The page is so arranged so that only one frame at a time is exposed.

The student reads the question and responds to the "frames" on the workbook pages either by selecting one of the multiple-choice responses or by constructing his own answer, depending upon the format employed in the program. He records his response on an answer sheet. He then slides the mask down the page to uncover the correct answer and compares it with his own response. Programming for the Learn-Ease units, like that for the Model 50, provide immediate reinforcement for correct answers and on-the-spot correction of wrong answers. This process also reveals the next frame. When the page has been completed, the student simply lifts the mask to one side, turns the workbook page and moves the slide-mask to the top of the grooved track and repeats the process.


LIFTING,CARRYING AND LOWERING
Programmed Workbooks
A Devereux Teaching Aid
The Devereux Foundation
Institute for Research and Training, Devon, Pennsylvania, 19333
A DEVEREUX TEACHING AID
THE DEVEREUX FOUNDATION
Institute for Research and Training
Devon, Pennsylvania, 19333

A sample instruction sheet for use of the Learn-Ease Programmed Workbook follows

DIRECTIONS FOR USING THE LEARN-EASE TEACHING AID



1. Place the back cover of the workbook in the slot as shown by the arrow above.

2. Open the workbook to the first page and place the SLIDING MASK so that it covers the answer column on the right side of the page.

3. Each frame asks you to pick the right answer. ALWAYS WRITE DOWN YOUR ANSWER on a separate piece of paper.

4. After you have written your answer, move the sliding mask down the page until you can see the answer to the question.

SAMPLE FRAMES

How many are 2 pens and 2 pens? 4 pens 3 pens 2 pens	4 pens
Which is the square? □ △ ▱	□

A pamphlet on "How to Use the Learn-Ease; Suggestions for Classroom Use," has been prepared and distributed. In addition, there was developed a companion leaflet, "How to Prepare Programs for the Learn-Ease Teaching Device" which has been helpful to those interested in doing their own programming.

Reproduced below is a section of the worksheet used by the programmer in preparing "frames" for the Learn-Ease programs.

The Learn-Ease programs, like those prepared for use on the Model 50 Teaching Aid, have been designed to complement regular teaching methods and are not expected to replace them. They can be useful as an introduction to a new unit of study and may also be helpful in providing practice to reinforce concepts already covered in the classroom. With a share of these teaching tasks transferred to the teaching aid, the teacher has more time for another aspect of teaching - giving personal attention to the problems and needs of the individual student.

The teaching aid itself can be made part of the plan of instruction for each student. The teacher should determine what special needs the student may have and select the programs which, in combination with other forms of instruction, will help meet his particular needs. By utilizing programmed material in this way, instruction can proceed on more than one level or on more than one topic at the same time in the same classroom.

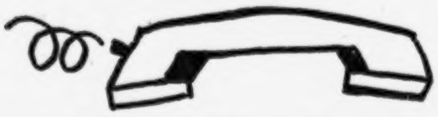
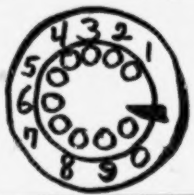
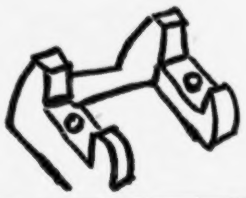
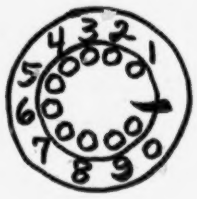
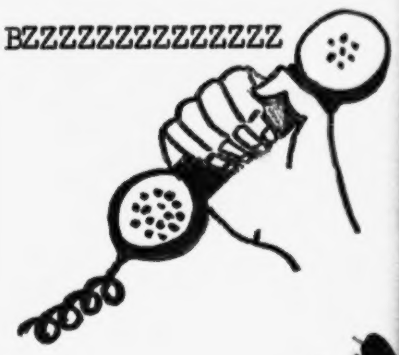
In the total time a student spends on a machine, he may go through the same program unit several times. The teacher can determine when to assign a new unit by watching the student as he goes through the material; findings on a simple post-test will show how well the student is doing and serve as a guide to the teacher in planning the next assignment for him.

A sample page from the Learn-Ease Programmed Workbook on "Using the Telephone" follows.

SAMPLE FRAME
FROM
LEARN-EASE PROGRAM

You use your finger to push the dial around.

This is called dialing.

Look at the telephone. The round part with holes in it is called the dial. Which is the dial?   	
What part of your hand do you use to dial? Your fist Your finger Your knuckle	Your finger
Put your finger in one of the holes of the dial.	
Push it around to the right. What are you doing? Dialing Listening Talking	Dialing
Before you dial, lift the receiver. You will hear ____________________. BZZZZZZZZZZZZZZZ Voices Ringing	BZZZZZZZZZZZZZZ 

Learn-Ease Programs have been adapted from those prepared for the Model 50 and include a series on: "Home Nursing," and one on "How to Use a Telephone". These are described on the preceding pages which discussed the programs prepared for the Devereux Model 50 Teaching Aid. The program content of each of these series is similar to that of the programmed workbooks on these same topics prepared for use on the Model 50 Device.

The need for instruction in safety and accident prevention is great, particularly with respect to the mental retardate. About one fourth of the reported compensation cases and about one fifth of all compensated permanent disabilities are the result of unsafe handling methods or conditions. A Learn-Ease program on proper methods of "Lifting, Carrying and Lowering" was prepared as one example of a programmed unit on job safety which could be prepared for use on this teaching device.

It is hoped that some insurance company, which publishes booklets on "safety," or a non-profit professional or trade organization concerned with promotion of industrial safety, may eventually publish this unit and/or sponsor other programmed materials on job safety and make them available on a national scale in the general interests of public safety.

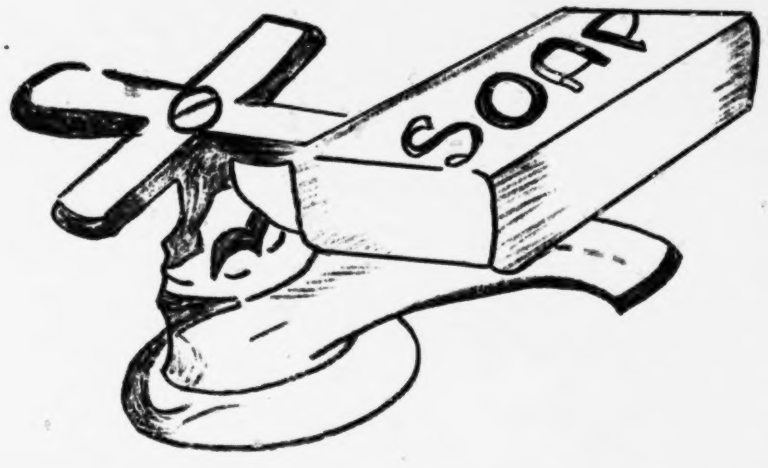
Student working on Learn-Ease Program on "Home Nursing". A sample page from one of the programmed workbooks in this series follows.

SAMPLE PAGE

Running hot water should always be used for hand washing.

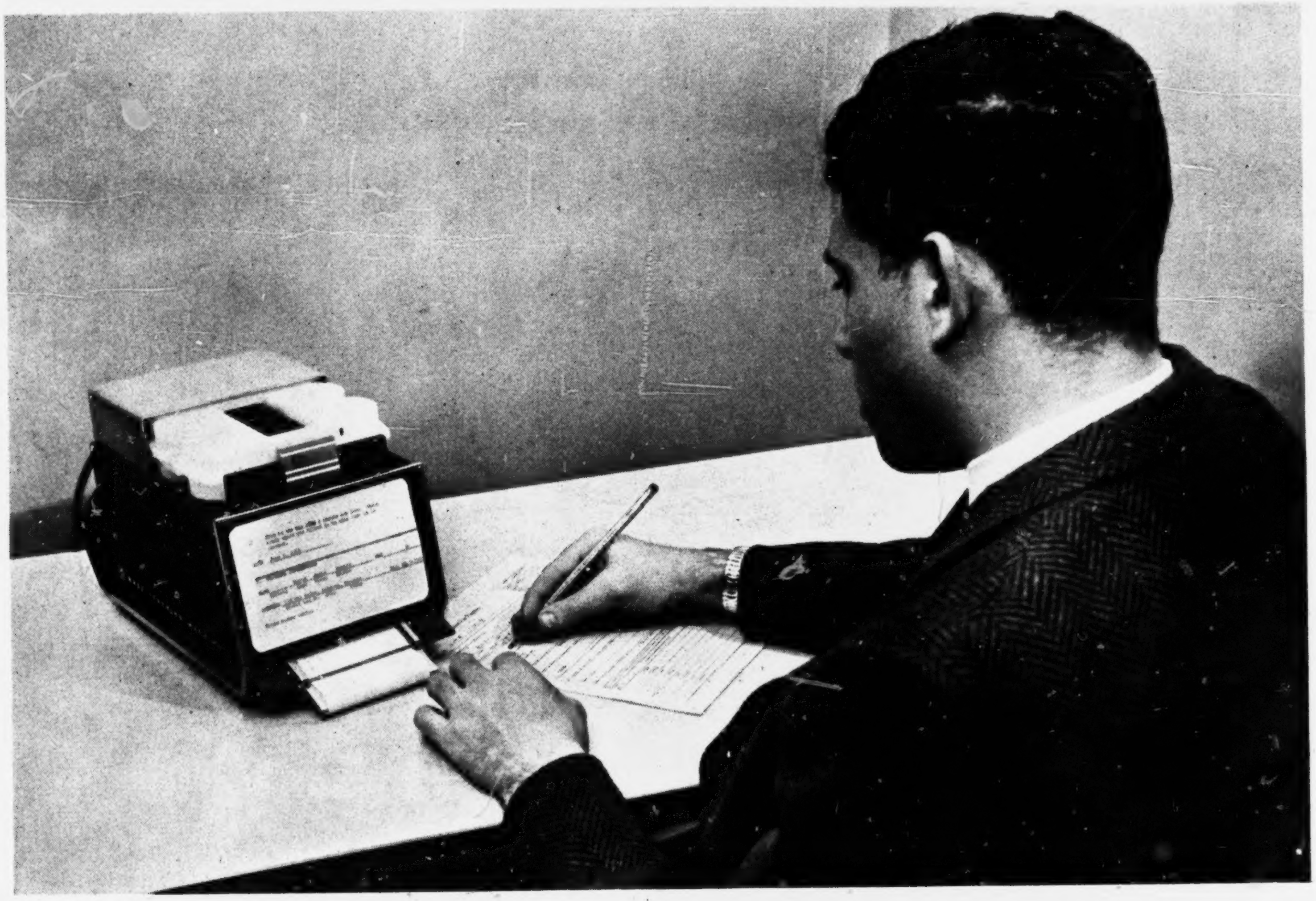
A bar of soap is needed to loosen the dirt.

The hot water and soap make a lather which gets rid of dirt and disease germs.



Two things that are needed for hand washing are hot water and clean hands disease germs a bar of soap	a bar of soap
The soap lather gets rid of the hot water the soap dirt and disease germs	dirt and disease germs
Running ______water must be used for hand washing. cold hot warm	hot
What loosens the dirt so it will wash away into the sink? disease germs the soap your hands	the soap
The soap lather gets rid of dirt which may contain disease germs soap hot water	disease germs
It takes hot water and ______to make a lather. towels soap disease germs	soap

THE MAST TEACHING MACHINE



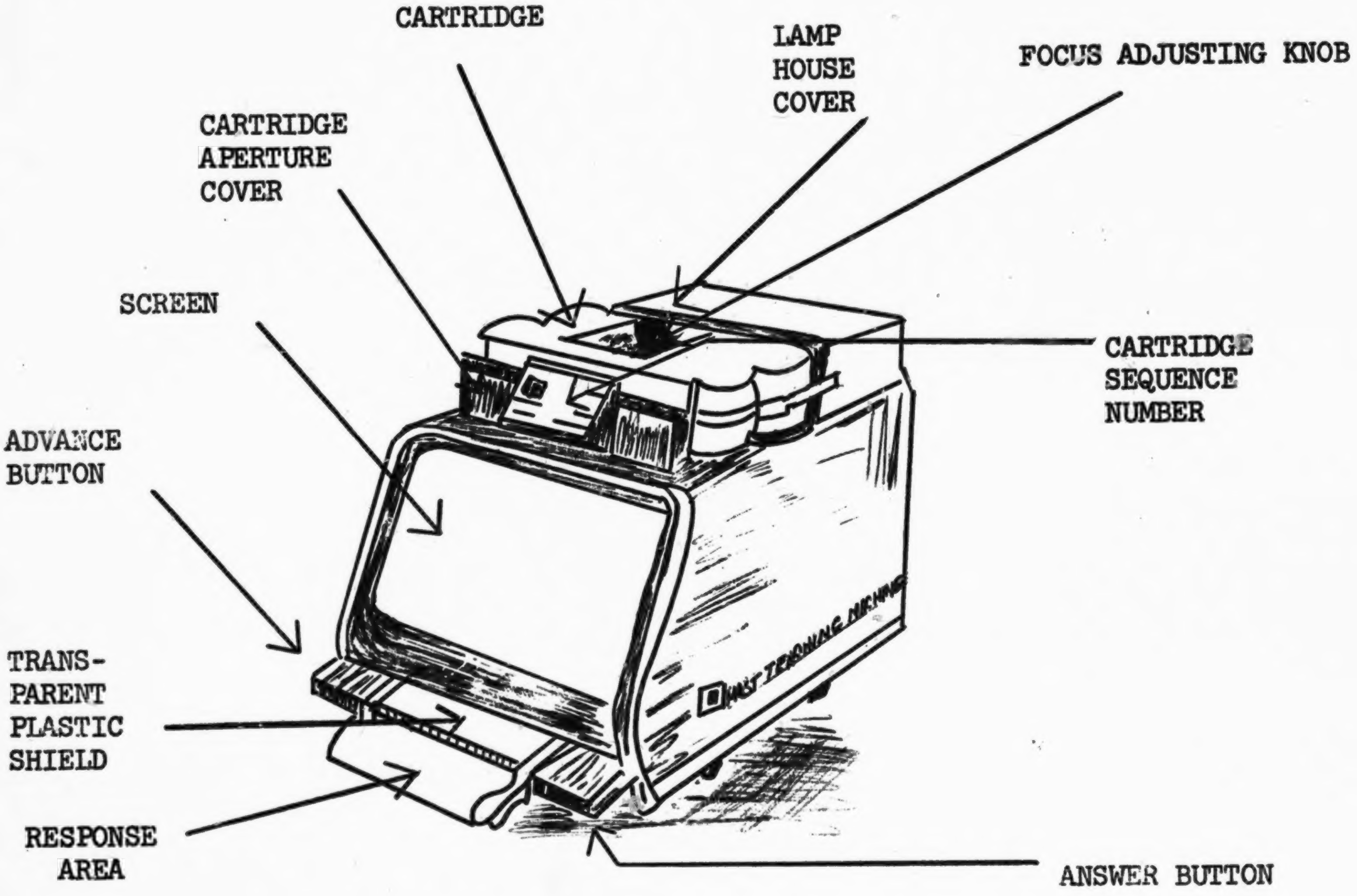
MAST TEACHING MACHINE - The Mast Teaching Machine is used as a teaching aid in a number of school settings throughout the country. It is a small, compact, photo-optical teaching aid which weighs 11 pounds and is electrically operated.

The instructional material of Mast programs is organized as "frames" or small parts of an overall lesson and follows the general techniques of linear programming; gradual step-by-step development of a point through the utilization of cueing, repetition and reinforcement.

The programmed lesson unit is presented on 35mm microfilm which is housed in a special plastic cartridge and is projected onto a 4" x 6" self-contained rear projection screen. The student views and responds to only one "frame" at a time without being distracted by extraneous material and writes the answer to each question in the space provided. He presses a button to reveal the correct answer. At the same time his own response slides under a transparent shield so he can't change the answer. The student compares his written answer with the correct one and he immediately learns whether it is right or wrong.

The Mast Teaching Machine may be purchased from the Mast Development Corporation, Davenport, Iowa.

If the answer is wrong, he writes in the correct answer before proceeding to the next step. In this manner, immediate positive reinforcement is given for the correct answer whereas wrong answers can be corrected at once. The student then presses an "advance button and the next frame comes into view. Thus, the student controls the rate at which the material is presented.


CARTRIDGE
LAMP HOUSE COVER
FOCUS ADJUSTING KNOB
CARTRIDGE APERTURE COVER
SCREEN
CARTRIDGE SEQUENCE NUMBER
ADVANCE BUTTON
TRANS-PARENT PLASTIC SHIELD
RESPONSE AREA
ANSWER BUTTON
MAST TEACHING MACHINE

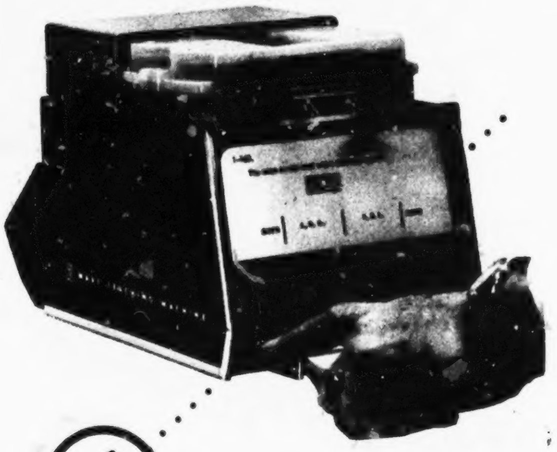
THE MAST TEACHING MACHINE

A pamphlet on "How to Use the Mast Teaching Machine; Suggestions for Classroom Use," has been prepared and distributed. In addition, a companion leaflet, "How to Prepare Programs for the Mast Teaching Aid," has been developed for use by those interested in preparing frames for Mast units.

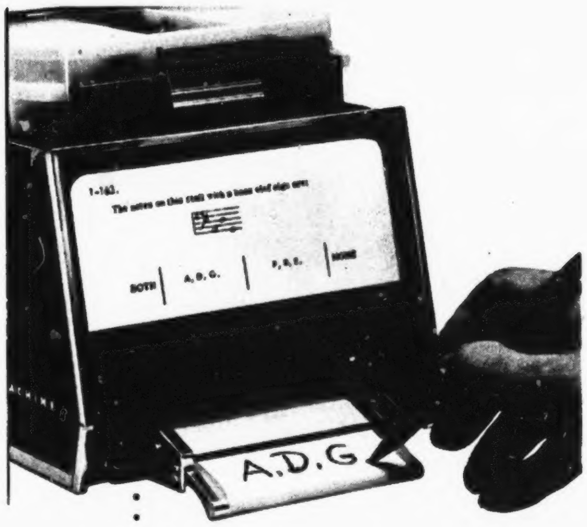
Mast frames are prepared on special program frames which tell exactly where to place the program material for microfilming.

A copy of the Instruction Sheet for Operation of the Mast Teaching Machine follows

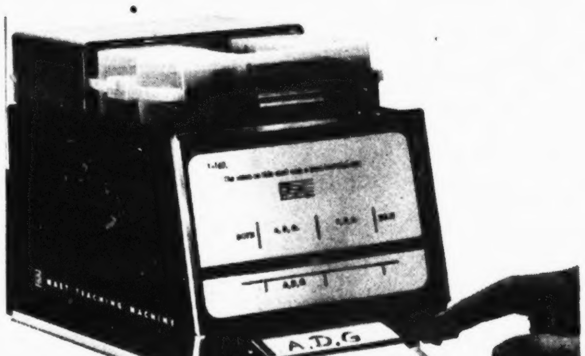
DIRECTIONS FOR USING THE MAST TEACHING MACHINE



① PRESS "ADVANCE"



② WRITE RESPONSE



③ PRESS "ANSWER"

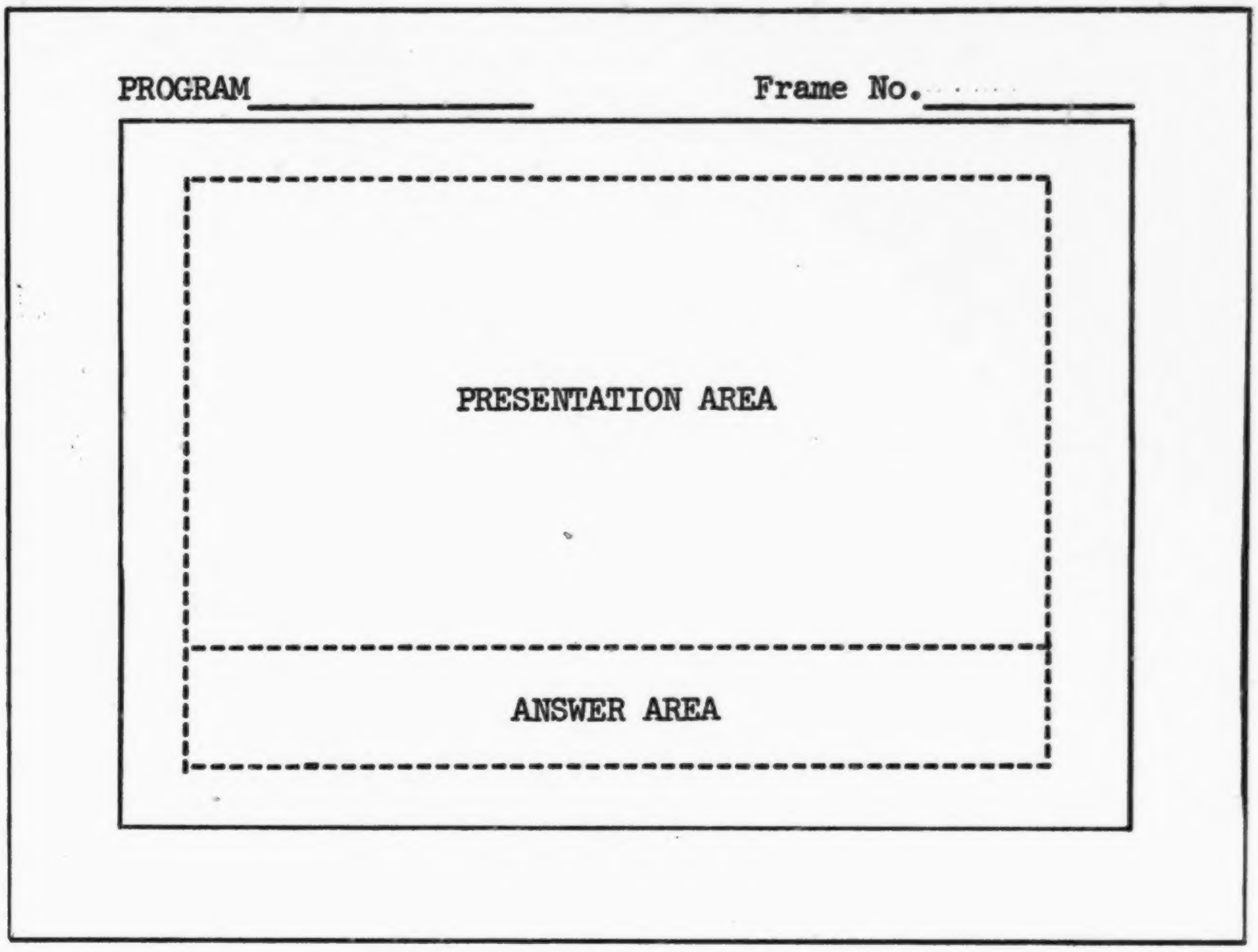
A - Study the question on the screen.

B - Write the answer in the space on the rolled sheet.

C - Press the "answer" button; the correct answer will be shown and your answer will slide under a shield.

D - Compare your answer with correct one; if your answer is wrong, write in the correct one.

E - Push the "advance" button on the left and continue.

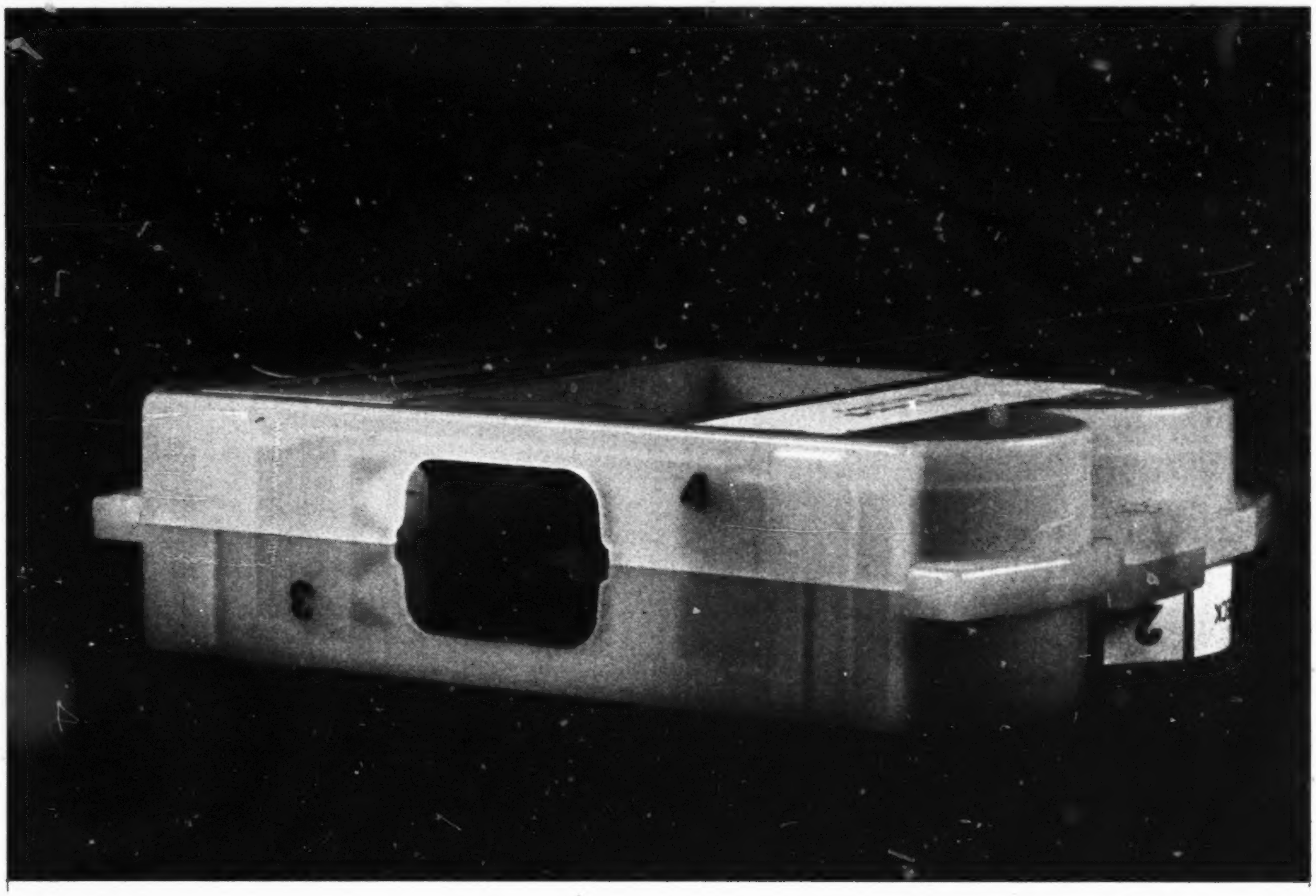


FORM USED FOR MAST FRAMES

The information portion of the item is placed in the Presentation Area which measures approximately 2½" x 5¼". The answer and instructions to the student after completing the frames, goes in the Answer Area, which is about 3/4" x 5¼". The frames are then tried out with a few students to get the "feel" of the prepared material and to "smooth" it out prior to microfilm processing.

The Mast Teaching Machine has been used successfully with mentally retarded and/or emotionally disturbed adolescents able to function on about a 5th grade academic level. The content material strives for a high interest level and the vocabulary has been adjusted to a 5th-6th grade level. Graphic material is used as much as possible to make the concepts clear. Appropriate drawings and diagrams are incorporated into the programs, as needed. When possible, sample items related to the lesson, i.e., a paycheck, are also provided to make the programmed instructional unit more meaningful.

The Mast programs are helpful to students with reading problems and to those more skilled in the manipulative and performance area than they are in the verbal areas. While the student with good verbal fluency may be using the perscribed classroom test, the student with poorly developed skills could be covering similar material which has been broken down into small steps of information and programmed for use on the Mast Machine to meet his particular needs.



Side view of plastic cartridge containing 35mm microfilm of programmed lesson unit.

Several programs is a series on ORIENTATION TO THE WORLD OF WORK have been prepared for use on the Mast Machine and complement the Model 50 programmed units. They are aimed at acquainting the student with typical procedures and situations he may expect to encounter as an on-the-job employee in industry. They have been used with teenage "underachievers" who function on an upper elementary or junior high school level. Some of these programmed units include:

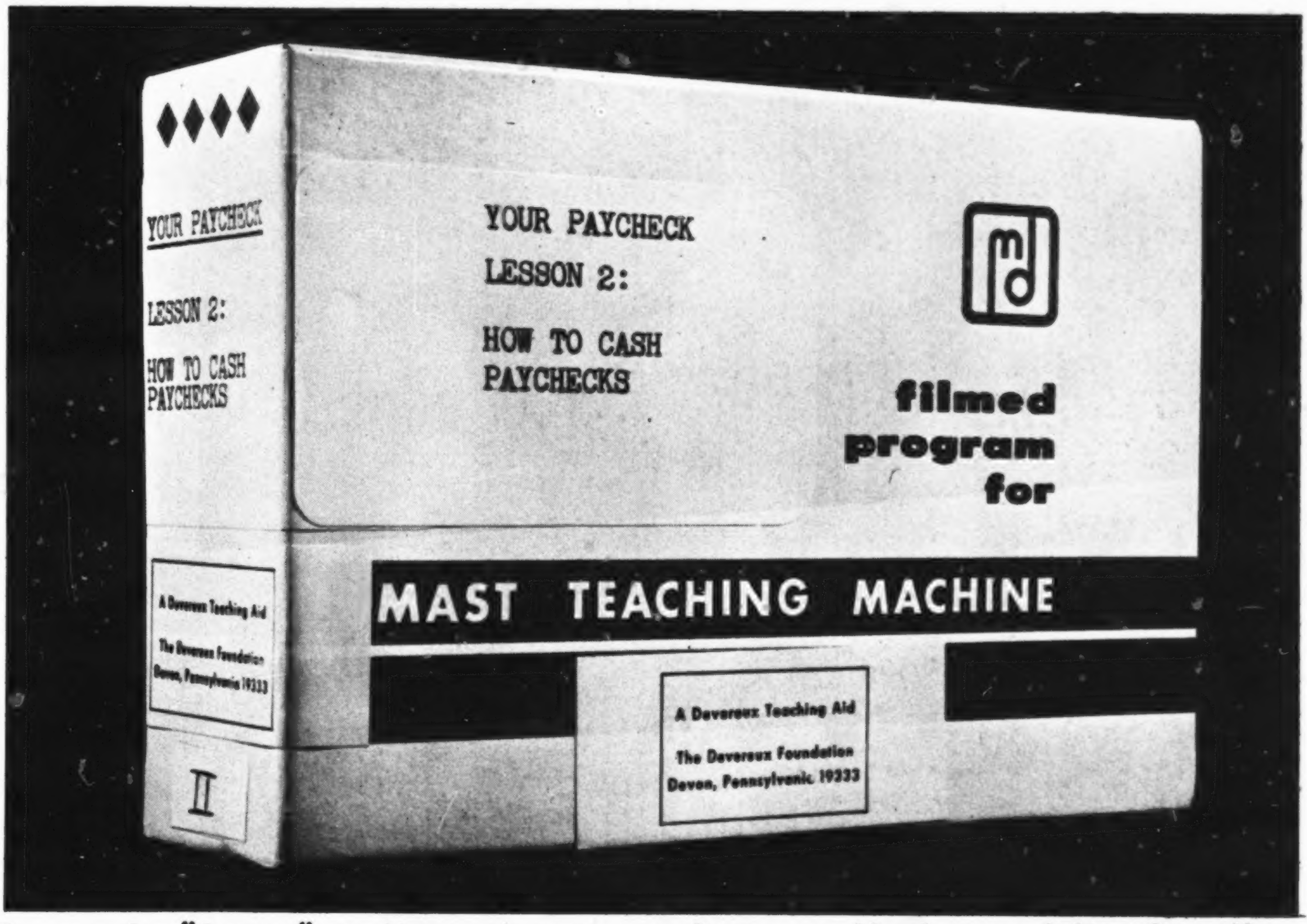
Filling Out the Job Application Form - Instruction in filling out a typical job application when seeking employment. Sample job applications are used along with the programmed instructional units which are made up into the following lessons: Lesson I - Personal Information; Lesson II - Type of Position Applying For; Lesson III - Previous Employment Record; Lesson IV-Educational Records; Lesson V - Personal References and Friends or Relatives Employed by the Same Company.

Your Pay Check - This program is comprised of five self-contained lessons which may be used individually or together as one instructional unit, depending upon the level of the student. Each lesson is followed by a summary quiz. The program includes: Lesson 1A - Exchanging Work for Wages; Lesson 1B - What a Paycheck Looks Like; Lesson II - How to Cash Your Paycheck.

Social Security - Information on wage deductions for social security, general orientation to the benefits under the Social Security Act. It is hoped that programmed instructional material of this type may be considered by the U.S. Social Security Administration for distribution on a national scale as a public service.

The Bank and Its Services - Introduces the student to basic banking terms; bank account, account number, deposit, etc. Purpose of a bank and difference between checking and savings account; basic bank functions of lending and borrowing money and interest payments are also covered. Lesson I - Checking and Savings Account; Lesson II - Lending and Borrowing Money.

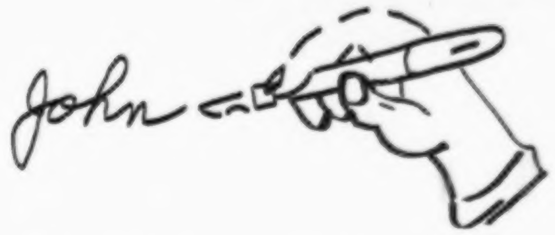
The Mast program can be made part of the plan of instruction for each student. They are well suited both for providing practice on material already learned and for presenting new concepts for the first time. With a share of these teaching tasks transferred to the teaching aid, the teacher has more time for another very important aspect of teaching - giving personal attention to the problems and needs of the individual student.



The sample "frames" on the next page are from a workbook page taken from the Mast program, "How to Cash Your Paycheck," a series of five lessons which may be used separately or together as one complete instructional unit, depending upon the level of the student. Each lesson is followed by a summary quiz. This unit deals primarily with the concepts of receiving pay for work done, of having pay deducted for taxes, of knowing in general what taxes are used for, how to cash a check, and what services a bank performs.

SAMPLE PAG
FROM MAST
TEACHING MACHIN
PROGRAM

21. Another thing to remember is always to endorse the check in ink.

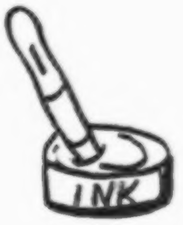


To endorse your check you would use ___?___.

a) a pen
b) a pencil

a pen

22. You will find pens at the bank so you can endorse your check in ___?___.



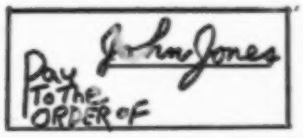
ink

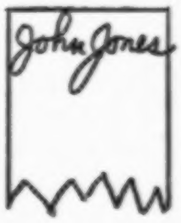
LET'S REVIEW THE SIX THINGS YOU HAVE LEARNED SO FAR ABOUT ENDORSING A CHECK

23. To endorse a check means to write your ___?___.

name

24. You must write your name on the back exactly as it is written on the ___?___.


Pay To The ORDER of
John Jones



front

THE GRAFLEX AUDIO-GRAPHIC INSTRUCTOR

GRAFLEX
AUDIO GRAPHIC

THE GRAFLEX INSTRUCTOR - The Graflex Audio-Graphic Instructor is a teaching device which projects 35mm color transparencies onto a rear vision screen to the accompaniment of a taped commentary. Impulses are recorded on the magnetic tape for automatic slide changes; also, for stopping the audio presentation after the taped instructions are given, to allow the student time to carry out taped instructions. He controls the instructional pace; he can stop the audio portion to study the pictures and he follows the simple spoken directions of the taped commentary to carry out the various assigned tasks.

Equipment with moving parts is intriguing to young people; they usually want to touch and to manipulate and to do something with these parts. The mental retardate is no exception in this regard, and he looks forward to the same experience.

Training activities, utilizing the Graflex, capitalize on exploratory or operant behavior in the learning situation and provide many opportunities for interesting and worthwhile learning experiences. In these programs, the student is instructed to "push the button", "pull the handle", etc. He can stop the sound of the machine, study the picture and start it again when he is ready for additional instruction.

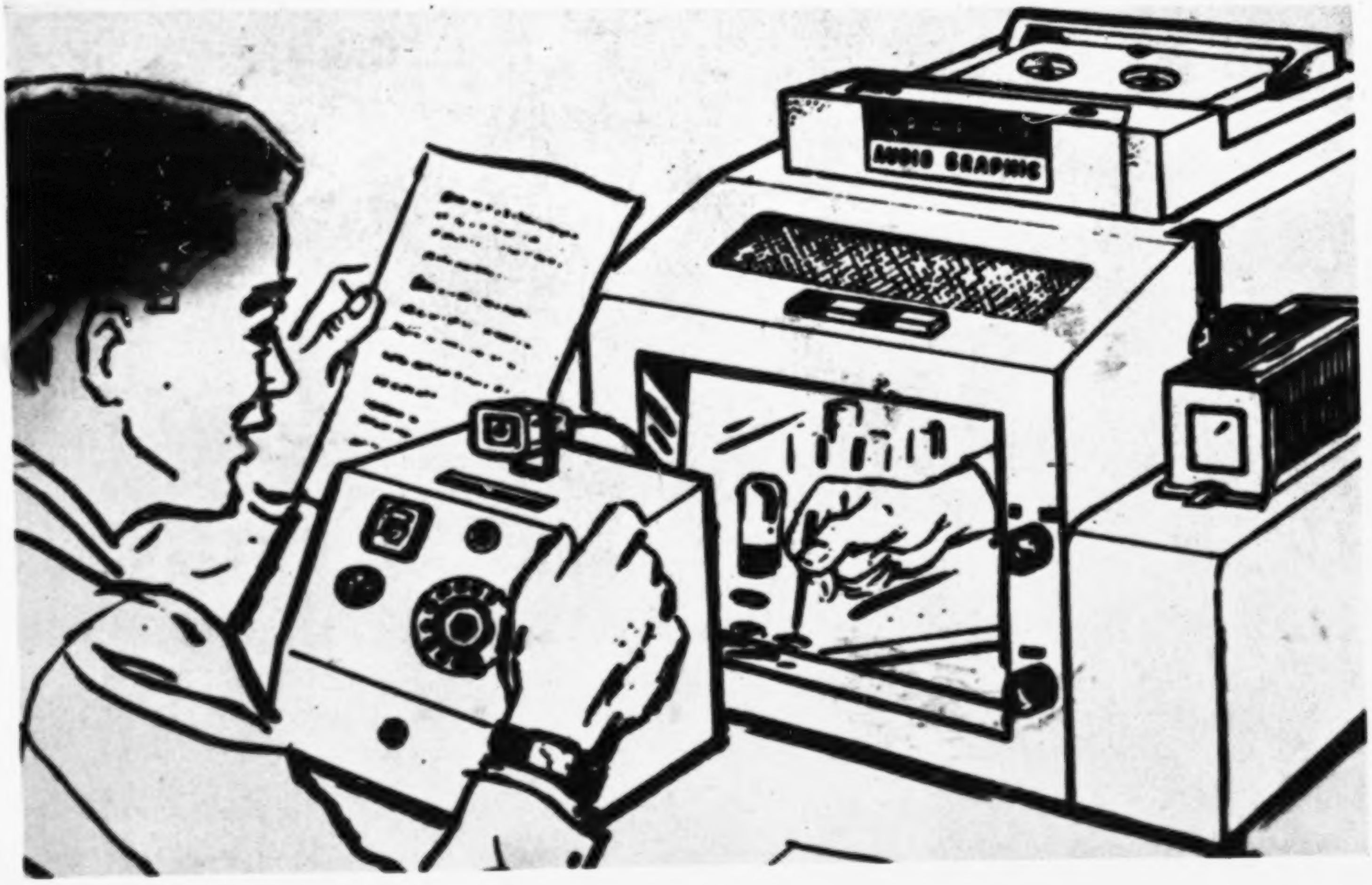
Programming techniques generally employed in linear programming, i.e., presenting small points of information, cueing, review, etc., are applied to the Graflex instructional programs. There is immediate knowledge of whether a response is appropriate and errors can be corrected before they become habitual.

The three-fold auditory, visual and kinesthetic approach utilized with the Graflex has many advantages for use in special education and in vocational training and provides the student with meaningful learning experiences.

Auditory stimulation is provided by a tape cartridge which plays a pre-recorded lesson.

Visual stimulation comes from the series of 2" x 2" slides graphically portrayed on the rear projection screen.

Kinesthetic stimulation is derived from "props" given to the student which he can handle and manipulate, i.e., a ruler, hand tools, electronics assembly items, etc. which provide an added opportunity to develop familiarity with the material or the task under study.



Adding the commentary to a Lesson Tape for use in a Graflex Instructional Program.

Self-Pacing - The Graflex is self-pacing; the student works through blocks of instruction at his own speed, stopping the machine at will to execute a task and starting the machine when he is ready to continue. Upon completing the assigned task, he steps on a pedal which starts the machine and the program continues. New and unfamiliar topics should be presented in self-pacing steps so that the student will have an opportunity to work at his own speed; the slower students will not be unduly penalized and the brighter students are not held back.

Pace-Setting - It is often desirable to have students perform a task at a certain rate of speed. In this case, a Graflex program with an objective of speeding up task performance can be designed so that it would be "pace-setting" rather than "self-pacing". In pace-setting programs, the students must keep abreast of the taped instructions and perform the operation as fast as they are shown on the screen. The student would not stop and start the machine but would continue to work at the established rate set by the machine. The rate of speed in such programs can be accelerated in degrees until the desired level of speed is reached, at which time the performance rate would be kept constant.

The Graflex Audio-Graphic System has been used as an "on-the-job" instructor for industry, the military and government services. Guided through each step of a complex mechanical or electronic assembly, an operator both sees and hears complete instructions in less time and with less distraction than is common under regular verbal instructional activity. It has been found helpful in industry for short run assembly operations. It has also proven to be helpful in providing "refresher" training when resuming operation after lapse of time. The Graflex unit can be set up at a distance from the main base of operation and instruction to the serviceman, for example, would be uniform as he may be told how to install, repair, or modify a piece of equipment, just as though the shop foreman was there in person to supervise the task.

Types of Programs Suitable for the Graflex - Although the Graflex can be used to present programs offering a wide diversity of subject matter, those which are difficult to visualize from written descriptions only, or those which require an abundance of graphic illustrations, lend themselves most readily to this form of presentation.

The Graflex is well suited for teaching job operations which require manipulation and physical activity as well as for teaching work-related topics. There is little advantage to using the Graflex to present programs which have as their objectives the teaching of information which is largely factual.

Students who can follow simple spoken directions with ease, but whose reading ability may be limited and a handicap to learning, benefit from instruction utilizing the Graflex. Many programs can be prepared which would require no reading. The self-activity of the programmed units gives the student a sense of being an integral part of the training situation, rather than being a bystander or simply taking orders in a classroom situation.

The Graflex Audio-Graphic Instructor is manufactured by Graflex, Inc., Rochester, New York.

Programs which have been developed for use on the Graflex include:

APPLYING FOR A JOB - A two-part coordinated program of slides and magnetic tapes presents importance of personal grooming and suggests points to remember in the job interview. Check lists are provided as well as a paper and pencil quiz.

Grooming for the Interview - Two automated instructional units stress the importance of personal cleanliness and of the selection and care of proper attire in the world-of-work; giving a prospective employer a favorable first impression; pre-interview pointers.

The Job Interview - Two lesson units explain how an employment interview is conducted and how the applicant should deport himself during the interview; the student listens to an actual job interview; common mistakes made in interviews and suggestions for avoiding errors are given.

THE WAITRESS - This program teaches the student how to be a good waitress. It discusses the importance of: (1) a clean and neat appearance at all times, (2) cheerfulness and friendliness toward the customers, (3) interest in the needs of the customer and concern as to whether he has everything he wants, and (4) accuracy in recording the customer's order.

[redacted]

[redacted]

Students in Training for Positions Related to the Food Services Benefit from the Graflex Instructional Program on "The Waitress"

HOW TO FILL OUT TAX FORMS - A detailed explanation on tape accompanied by color slides discusses the withholding tax statement furnished by the employer for use in computing the tax and the mechanics involved in completing the Federal Income Tax Form 1040A.

HOW TO USE A CASH REGISTER - Instruction in the use of a Victor Cash Register, such as is used in some small business establishments; an actual cash register is used along with the Graflex. The programmed unit covers the use of the keyboard; how to register cash amounts; finding totals and subtotals; correcting errors.

BASIC SHOP INFORMATION - These programs overcome many limitations encountered in programming with the Model 50 Teaching Aid. They attempt to teach a manual operation, as distinguished from presenting factual information through the programmed instructional workbooks on the Model 50. The attendance of the shop instructor is necessary for consultation and for emergency assistance.

Measuring With a Ruler - Slides and practical exercises in linear measurement cover the basic divisions of the inch; the use of the standard 12-inch ruler. In addition to viewing the slides and listening to the taped instructions, the student is also provided with answer sheets and an actual ruler which he manipulates during the course of instruction.

Six lessons, encompassed in three parts, cover the basic aspects of linear measurements and use of the ruler to measure in units ranging from 1/16" through the full inch.

Continuity Checks - A step-by-step explanation of a basic step in electronics -- how to use a voltmeter in a continuity check to determine whether or not a wire is continuous and will conduct a current. The technique is useful in locating broken wires and in identifying leads when several wires form a cable.

An actual experiment is performed; the student is given a voltmeter and a small practice board of colored wires, some of which are broken and some continuous. The Graflex slides portray the same equipment he is working with. The program may be used to teach how to perform continuity checks on small electrical appliances of the type which find their way to neighborhood repair shops.

The Wood Lathe - This program teaches the student how to operate a wood turning lathe, the machine used in making furniture and certain turned accessories. Attention is focused upon the use of the gouge, skew, parting tool, square nose, round nose, and diamond-point in operations of turning and cutting. There is also some discussion of safety measures which must be taken when these tools are being utilized.

The Drill Press - The parts and specifications of the standard floor model drill press and how it is used for both wood and metal work; operations of boring, routing, shaping, etc., will be taught. This unit provides the staff with opportunities to work through many challenging and technical difficulties to be expected in programming of other shop tools and processes.

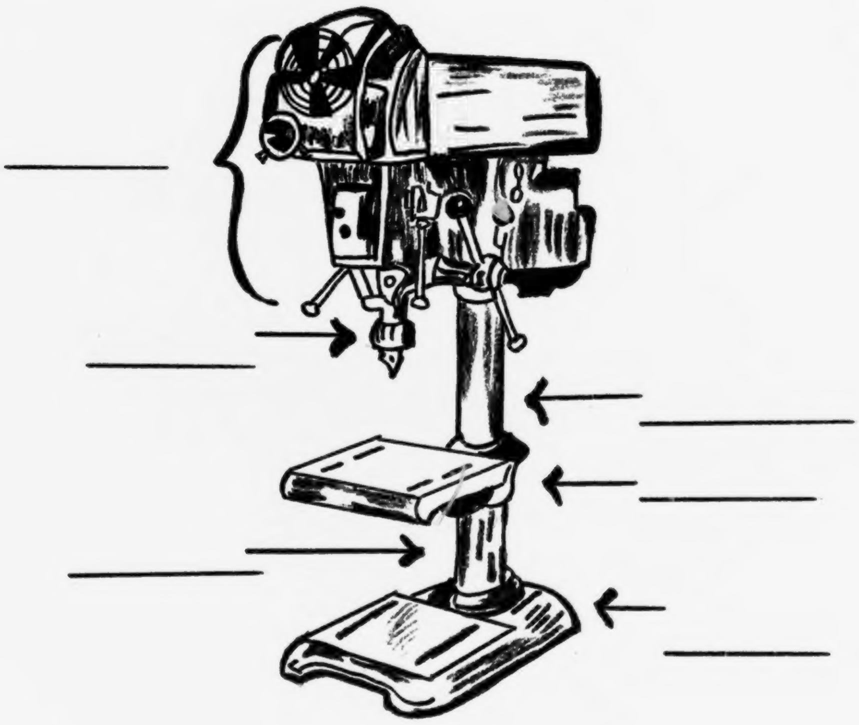
A sample frame from the Graflex Program on "The Drill Press" follows.

SAMPLE FRAME
FROM GRAFLEX
PROGRAM ON THE
DRILL PRESS

Taped Directions:

Now let's review a few of the things we have learned so far. We'll start by labeling the parts of the drill press which the arrows point to in the sketch. When you have finished labeling the parts, step on the green pedal on the floor.

SLIDE:



Student Activity:

The student has on hand the specific items discussed on tape and graphically portrayed on the slides; he manipulates them and/or performs the required tasks as per the taped instructions.

There is reproduced below brief segments from three Graflex instructional programs to illustrate the use of the audio, visual and kinesthetic stimuli in these training activities. It should be noted that the sample commentary is not continuous and for purposes of illustration is made up of small segments taken from these program.

Excerpt from an Early Graflex Program on Measuring with a Ruler

Slide (Ruler)

Tape "Now a ruler is something that you measure with. You should have one there".

"You should also have a piece of paper and pencil and a blue box".

"You should have a ruler, a piece of paper and a pencil and a blue box that has a whole bunch of stuff in it".

Slide (Finger on Two Inch Mark)

Tape "Now here we are showing how to measure with a ruler - how long two inches are. It's two inches from the end of the ruler down to where the finger is showing".

"The finger is pointing to a line that has a number 2 by it, that means it's two inches from the end of the ruler down to that place, down to that line".

"Now, on your ruler can you put your finger to show how far two inches are?"

Slide (Red Block)

Tape "Now this time, find the red block, the red block with a letter A on it. Place the block against your ruler making sure that the end of the ruler and the end of the block are even, just as they are in the picture."

"Now, remember what we learned and write on your answer sheet; how long the red block is. How far is it from the end of the block to where the pencil is pointing?"

Basic Shop Information learned in the Graflex Instructional Program is employed later on in practical on-the-job training.

Several "shop" units have been developed. "The Drill Press" unit describes the standard floor model drill press and how it is used for both wood and metal work; operations of boring, routing, shaping, etc. are taught. "The Wood Lathe" provides the student with instruction on the use of two different types of wood lathes, and covers use of various lathe tools and operations of turning, sanding, etc.

Excerpt from Graflex Program on "The Lathe".

Slide (Inserting Wood on Lathe)

Tape "Now take the wood with the spur hammered in its end; carefully insert the spur into the head stock."

"Watch how the man in the picture is doing it. Be careful that you don't knock the spur out of the wood as you are doing this."

Consideration has been given to the use of Graflex instructional programs in teaching job operations which require manipulation and physical activity, as for example, in checking electrical contact continuity in small household appliances, of the type which find their way in neighborhood "fix-it" shops for repair.

Excerpt from Graflex Program on Continuity Checks

Slide (Continuity Check Board)

Tape "Now take the little blue board marked Continuity Check Board. Put this board in front of you."

Slide (One Hand and Meter)

Tape "Now take the black prod and touch it to the metal strip at the left end of the black wire at the top of the board. Do as the man in the picture is doing. He has firmly touched the black prod to the left end of the black wire at the top of the board. Make sure you have a firm contact."

Slide (Two Hands and Meter)

Tape "Now take the red prod and touch it to the right side of the board where the black wire is fastened to the metal strip. Do as the man in the picture is doing."

Slide (Two Hands and Pencil)

Tape "When you touched the red prod to the board, the needle on the dial of the voltmeter should have swung to the right. If the needle on your voltmeter swung all the way to the right, that indicates that the black wire on the board is continuous. That's the reason this is called a continuity check."

Programmed Lesson Units Related to the TOWER System - Devereux utilizes the TOWER System, a program for evaluating work potential through simulated work samples, to obtain a wider perspective of the student's potentials and occupational readiness. Vocational areas sampled by the TOWER tests include: clerical skills, drawing, drafting, electronics assembly, jewelry manufacturing, leather goods, lettering, mail clerk, receptionist, sewing machine operator, and workshop assembly. A TOWER appraisal explores entry occupations ranging from those which require little or no training, to positions of greater skill for which prerequisite training may be necessary.

Use of the TOWER tests at Devereux highlighted the need for a more objective means of test presentation to reduce or eliminate bias of the evaluator from influencing the appraisal. It was felt that programmed instructional techniques could be applied to the TOWER appraisals and that such techniques would provide a more objective evaluation procedure since the instructions would be identical for each student. Moreover, a mode of presentation which utilized both auditory and visual components would be most beneficial to students with reading problems and to those who have difficulty in visualizing complex operations when instructions are presented in the conventional manner during the TOWER appraisal.

In programming TOWER tests for use on the Graflex Machine, the student may repeat the showing of the visual materials or control the taped commentary, as needed. This tends to increase the reliability of the TOWER evaluation by insuring the student's learning of the operation under study. Under the conventional mode of presentation, there was a greater chance of the student being penalized in the evaluation because he did not learn a particular task too well. Thus, what might appear on the evaluation to be a lack of aptitude or skill, might in fact have been an incomplete learning of the required task. It was felt that the TOWER system appraisal of the student's vocational potential followed by automated instruction in the area recommended for vocational exploration would provide a more extensive pre-vocational sampling of various job fields, prior to entering an occupational area. A pilot programmed instructional unit on the TOWER System for use with the Devereux Model 50 Teaching Aid has also been prepared and is described in Section III.

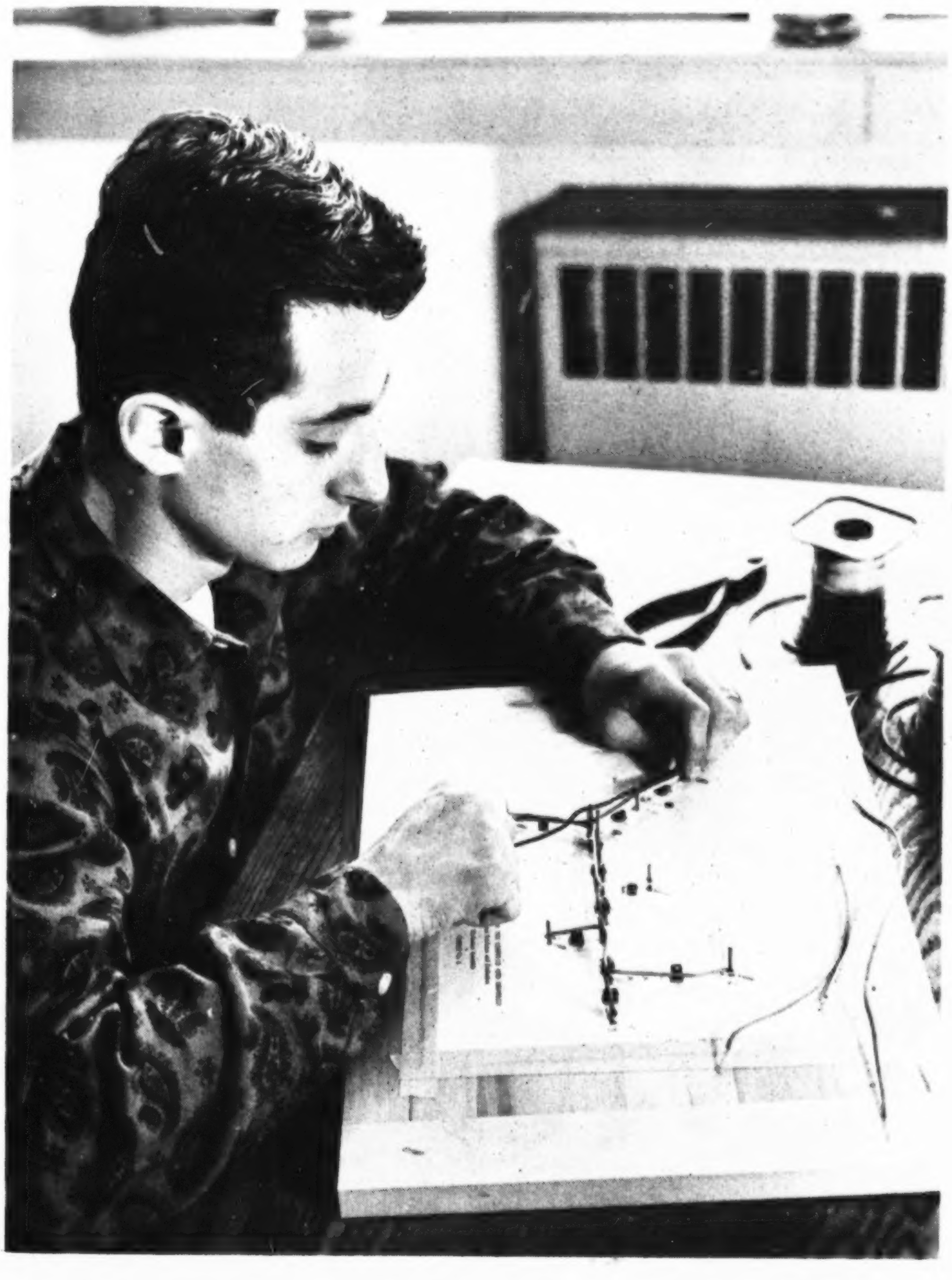
The TOWER appraisals are currently being used in a pre-vocational training unit of the Devereux Schools. The population of this unit is primarily mentally retarded, some with neurological impairment and/or emotional overlay associated with the retardation. Generally, the TOWER program appears to work more effectively with retarded than with emotionally handicapped students. The performance of the emotionally disturbed individual is too variable to give a reliable evaluation of their skills in testing. However, mentally retarded adolescents are more consistent in their performance and hence test data from them are more reliable indicators of work potential.

Two instructional units of the TOWER system of vocational appraisals were prepared for presentation on the Graflex. The selection was largely determined by the ease with which the unit could be divided into operational steps which could be programmed with facility. The visual and auditory components of each programmed step had to be clear and concise in order to minimize misunderstanding of instructions. The selected units met these criteria for they consist mainly of manual operations which are easily photographed. The verbal instructions are taped and coordinated with the slide presentations. The original TOWER instructions have not been changed to any great extent and only minor modifications were made in adapting them to Graflex presentation.

Pilot programs which have been prepared in the TOWER series include:

Electronics Assembly - Covers the ten parts of the TOWER electronics assembly work-sample. The student performs the required tasks to a taped commentary accompanied by colored slides; he is required to lace a cable harness, to solder, to learn the color code of wires, and to become familiar with the various techniques of wiring and assembling.

Leathergoods - The student is required to use such tools as: dividers, knife, steel square, and cutting board in cutting pieces of material and leatherette to specific shapes and sizes. He then assembles items such as an ashtray and desk pad.



Providing Practice in Electronics Assembly Activities Through the Simulated Work Samples of the TOWER System.

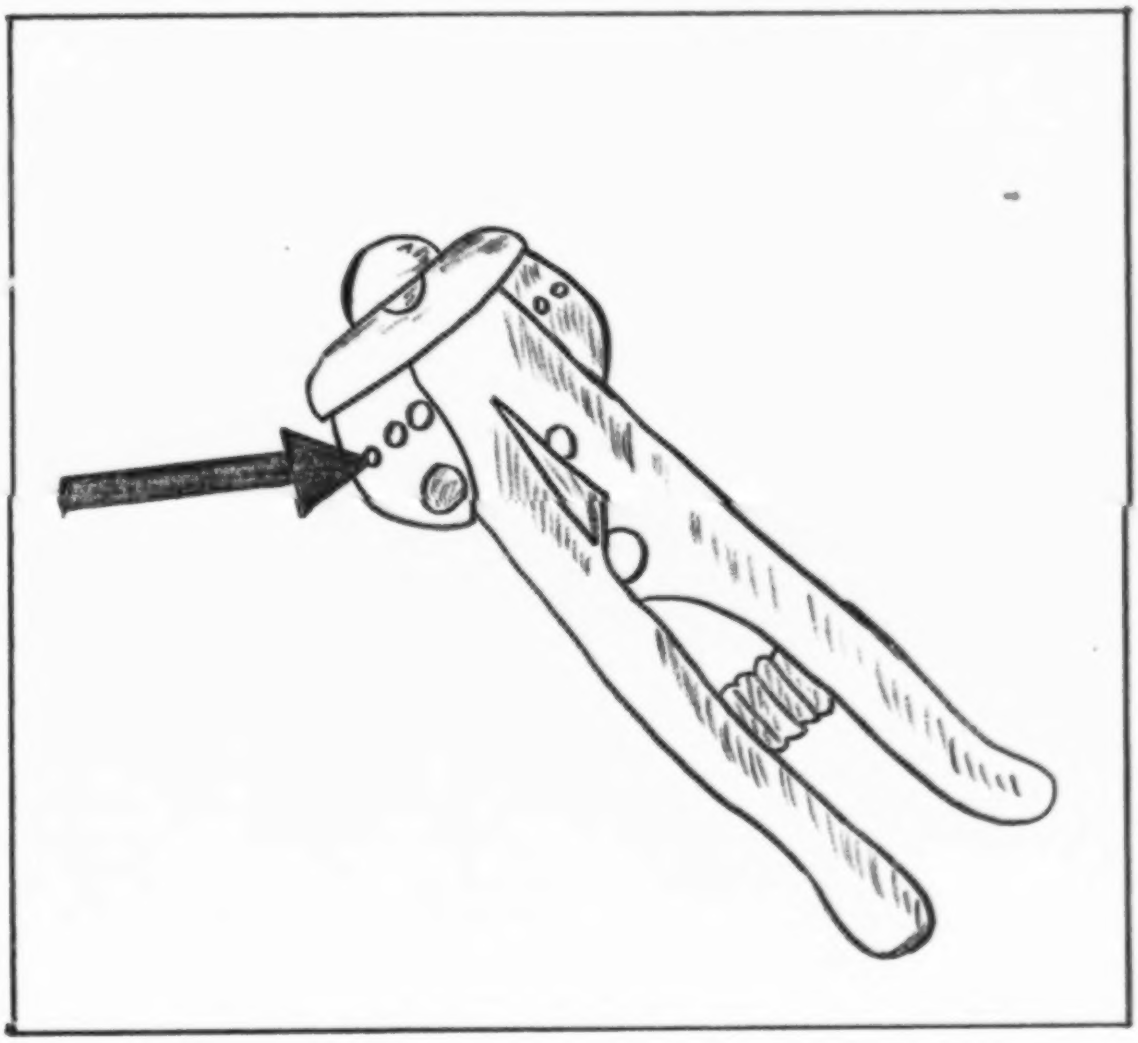
A sample frame from the Graflex program in "Electronics Assembly" follows.

SAMPLE FRAME FROM
GRAFLEX PROGRAM ON
ELECTRONICS ASSEMBLY

Taped Directions:

"The insulation is removed by using stripping pliers. They have cutting holes for all gauges of wires: 10, 12, 14, 16, 18, etc. 18 gauge is the wire you are using. The red arrow points to this hole on the pliers."

Slide



Student Activity:

The student has on hand the specific items discussed on tape and graphically portrayed on the slides; he manipulates them and/or performs the required tasks as per the taped instructions.

KODAK CAROUSEL 800
PROJECTOR
Kodak
CAROUSEL 800

A Kodak Carousel Projector is Utilized as One of the Basic Components

THE CAR-TAP TEACHING AID - The Car-Tap (Carousel and Tape Recorder) Teaching Aid is essentially an adaptation of the Graflex Audio-Graphic Instructor and the Graflex instructional programs. It was evolved during the course of the Automated Instructional Aids Project. As the project approached the terminal stage it appeared that consideration might be given to a technique for adapting the Graflex programs to a presentation requiring lighter weight equipment which would be less cumbersome and less complicated to use and to repair, cost less to purchase and to maintain.

The evolved procedure makes use of equipment available in many public schools and agency settings. The equipment consists of: (1) an Eastman Kodak Carousel Projector of the Model Number 800 series; (2) any suitable tape recorder which can be hooked up with the Carousel Projector; (3) a special piece of equipment, a Carousel Programmer, a comparatively inexpensive piece of equipment which may be purchased locally for use with the Carousel Projector; (4) a regular motion picture screen is also desirable.

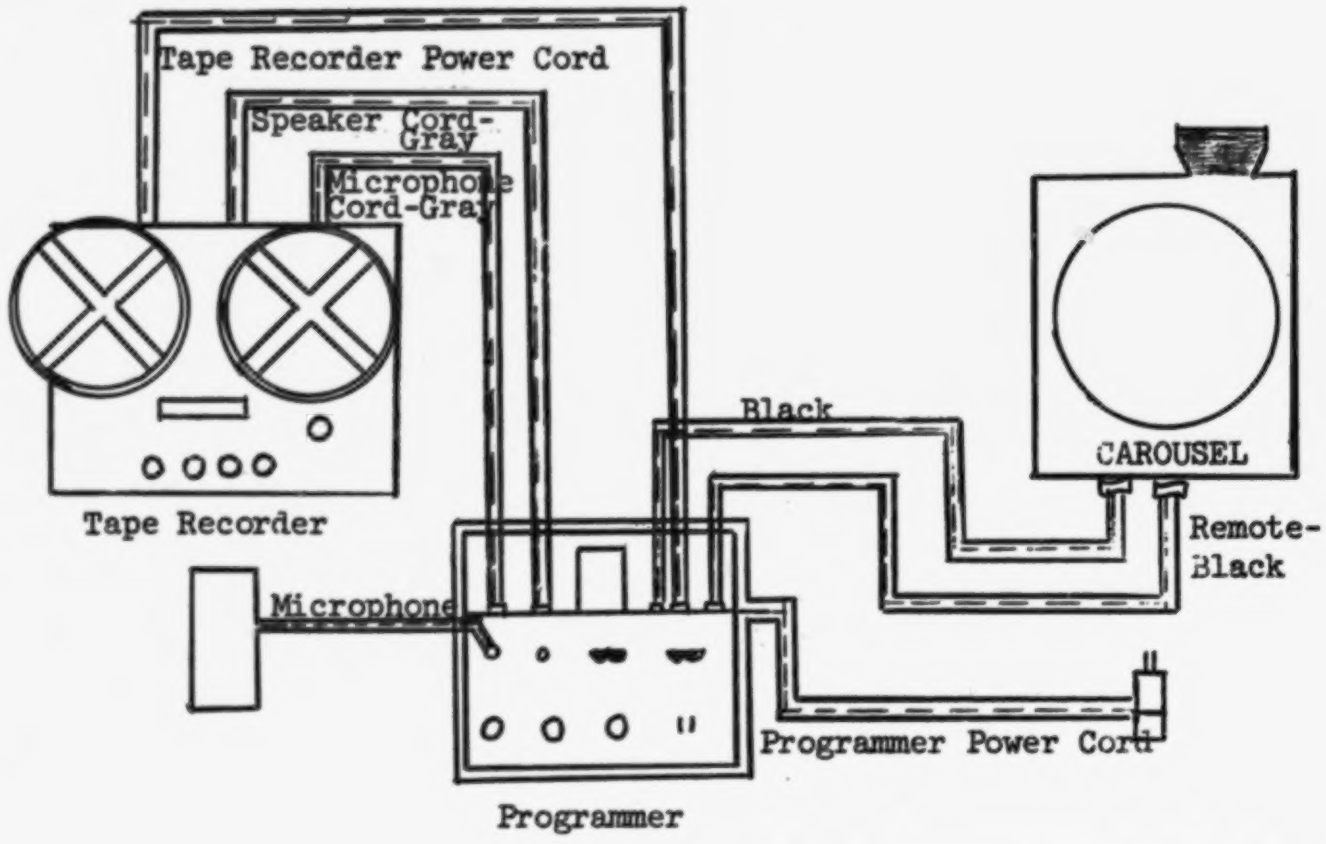
The Car-Tap Teaching Aid Unit, like the Graflex Audio-Graphic Instructor, is a device which projects regular 35mm color transparencies onto a screen to the accompaniment of a taped commentary. The slides prepared for use on the Graflex equipment may also be used on the Car-Tap Unit. The taped commentary accompanying the Graflex material may also be used; however, it must be recorded on a new tape for use on the tape recorder which will be used with the Car-Tap Unit, since the Graflex tape utilizes a special cartridge holder.

This Car-Tap technique adapts the Graflex programs, ordinarily utilized for individual instruction, to a group procedure, without reducing the quality and effectiveness of the instructional programs. It also provides a means for group presentation of automated instructional material which is already available to many educational institutions, is within the technical skills of most classroom teachers, and would not require involved training for personnel interested in making use of this procedure.

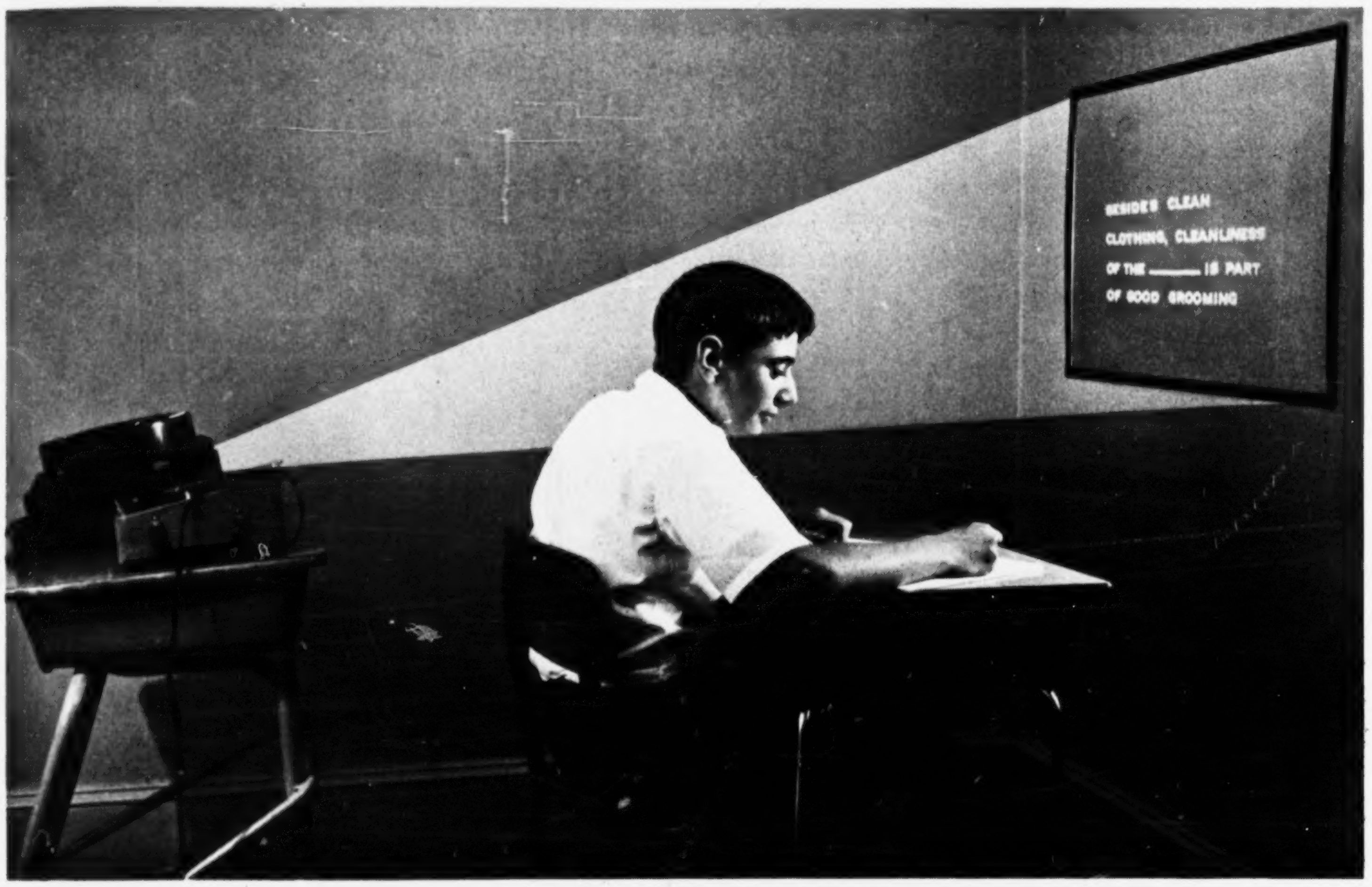
The preparation of a Car-Tap program is a relatively simple procedure, once the slides have been taken. The recording of the tape involves the previously described equipment set up as shown in the diagram below:

Setting Up the Equipment

RECORDING


Tape Recorder Power Cord
Speaker Cord-Gray
Microphone Cord-Gray
Black
CAROUSEL
Remote-Black
Tape Recorder
Microphone
Programmer Power Cord
Programmer

THE SET-UP FOR RECORDING CAR-TAP PROGRAMS



THE CAR-TAP UNIT IN USE

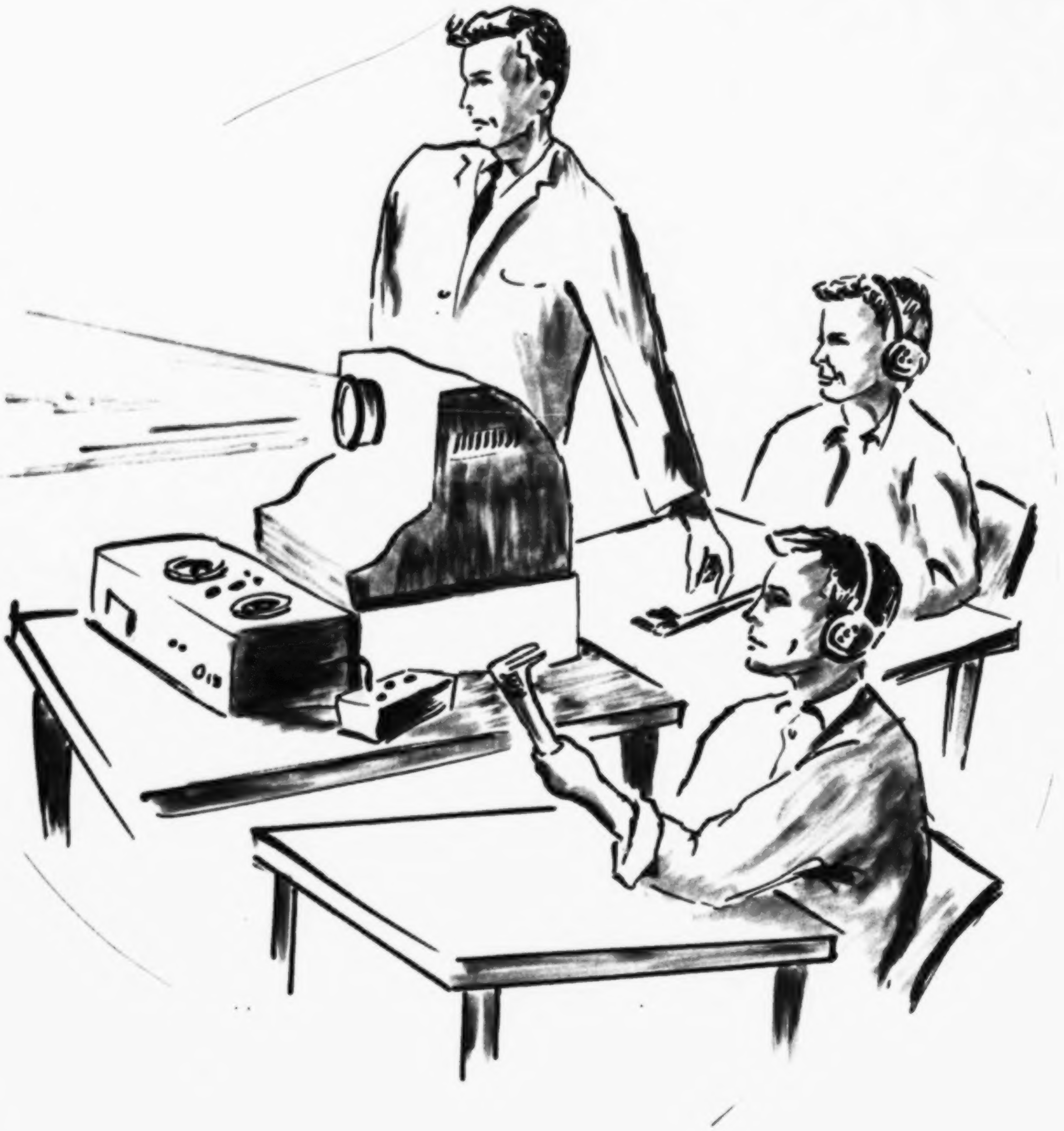
In the above photograph only one student is shown at work. In a group situation either one of the students or the classroom instructor would handle the equipment. The projector and programmer are seen on the desk behind the student. The tape recorder (not shown) is set up and playing in the background. To completely exclude extraneous auditory stimuli, a set of earphones may be provided to the student. Impulses are recorded on the tape for automatic slide changes. As in the case of the Graflex programs, the Car-Tap programs are self-pacing and one student can control the instructional pace.

There has been little opportunity to field test the effectiveness of the Car-Tap technique as compared to the use of the Graflex Audio Graphic Instructor; however, preliminary try-outs of the equipment suggest that the procedure is worthy of further exploration. It is hoped that other investigators will be interested to continue to work with the equipment and further explore its possibilities for use in vocational training of mentally retarded and emotionally handicapped youth.

A leaflet giving instructions for utilizing the Carousel Projector and other equipment described above in a Car-Tap Unit has been prepared by the project staff and distributed to interested individuals.

The Kodak Carousel Projector and Programmer may be purchased from most local distributors of Eastman Kodak products. Further information on this equipment may be obtained from the Eastman Kodak Co., Customer Service Division, Rochester, N. Y.

THE A-V-K TECHNIQUE



A-V-K PROGRAMMING - A technique which is called, for want of a better name, A-V-K Programming, was employed in the automated teaching aids project. The letters stand for "Auditory" - "Visual" - "Kinesthetic" stimuli. The technique offers much promise in programming for the student who is a poor reader and for the mentally retarded student in the 50-70 I.Q. range.

Many slow learners are handicapped by poor reading ability; jobs which might be of interest to them are often overlooked because of an inability to read promotional or ordinary newspaper material prepared to orient young people to the world-of-work and to the basic skills that are required for various jobs. The A-V-K programs attempt to make job information available through small, programmed instructional units, designed specifically for the retardate in the lower I.Q. range. They have been well received by students in this group.

The technique for presentation is a group procedure which resembles a small homemade language laboratory and accommodates six students and one instructor.

The basic equipment for A-V-K programming is generally available in many settings, particularly in public schools, community centers, state schools and institutions serving the mentally retarded, and consists primarily of an opaque or overhead projector set-up which utilizes a coordinated taped lesson and makes use of multi-sensory stimuli.

The required equipment includes a tape recorder which can accommodate a 5" reel of tape. Also, a simple jackbox which plugs into the tape recorder and accommodates six earphone attachments that are in turn connected to individual volume control units. This piece of equipment can be easily constructed by a local radio repair shop at a very small cost.

A regular opaque projector or an overhead projector which projects transparencies is also used. Visual Aids are required for projection by the opaque or the overhead projector. In addition, readily available and inexpensive "props", i.e., nuts and bolts, measuring cups, etc. which can be handled by the student during the course of the lesson are also utilized to enrich the lesson.

The lessons and review material follow the general tenets of linear programming techniques described on the preceding pages in summarizing the programming techniques employed in the teaching aids project; small points of information are introduced and there is a gradual step-by-step development of learning with provisions for cueing, repetition and reinforcement of learning.

Multi-sensory Stimuli are Employed - The A-V-K instructional programs, as in the case of automated programmed units prepared for the Graflex Audio-Graphic Instructor, make use of multi-sensory stimuli:

Auditory Stimulation is provided by a pre-recorded lesson tape which the student hears through the earphones connected to the tape recorder.

Visual Stimulation comes from graphic aids such as: homemade drawings, illustrations from a book, or pictures, cartoons, advertising copy, etc., which may be used directly from, or cut out of, newspapers and magazines, which are projected by means of the opaque projector onto a screen or the wall. If suitable equipment and supplies are available for making of transparent projectuals, these can be prepared and shown by means of an overhead projector.

Kinesthetic Stimulation is derived from the "props" which are keyed to the lesson units. The "props" are placed before the student for him to handle and manipulate as directed by the taped commentary. Additional kinesthetic stimulation also comes from the student's written responses to a simple review and quiz sheet.

The average lesson may take an hour but is broken down into small units, each requiring ten or fifteen minutes to complete. The length of time spent by each student or any one A-V-K program will vary from program to program and will depend, to some extent, on the attention span, threshold of fatigue, and the individual capabilities of the particular student.

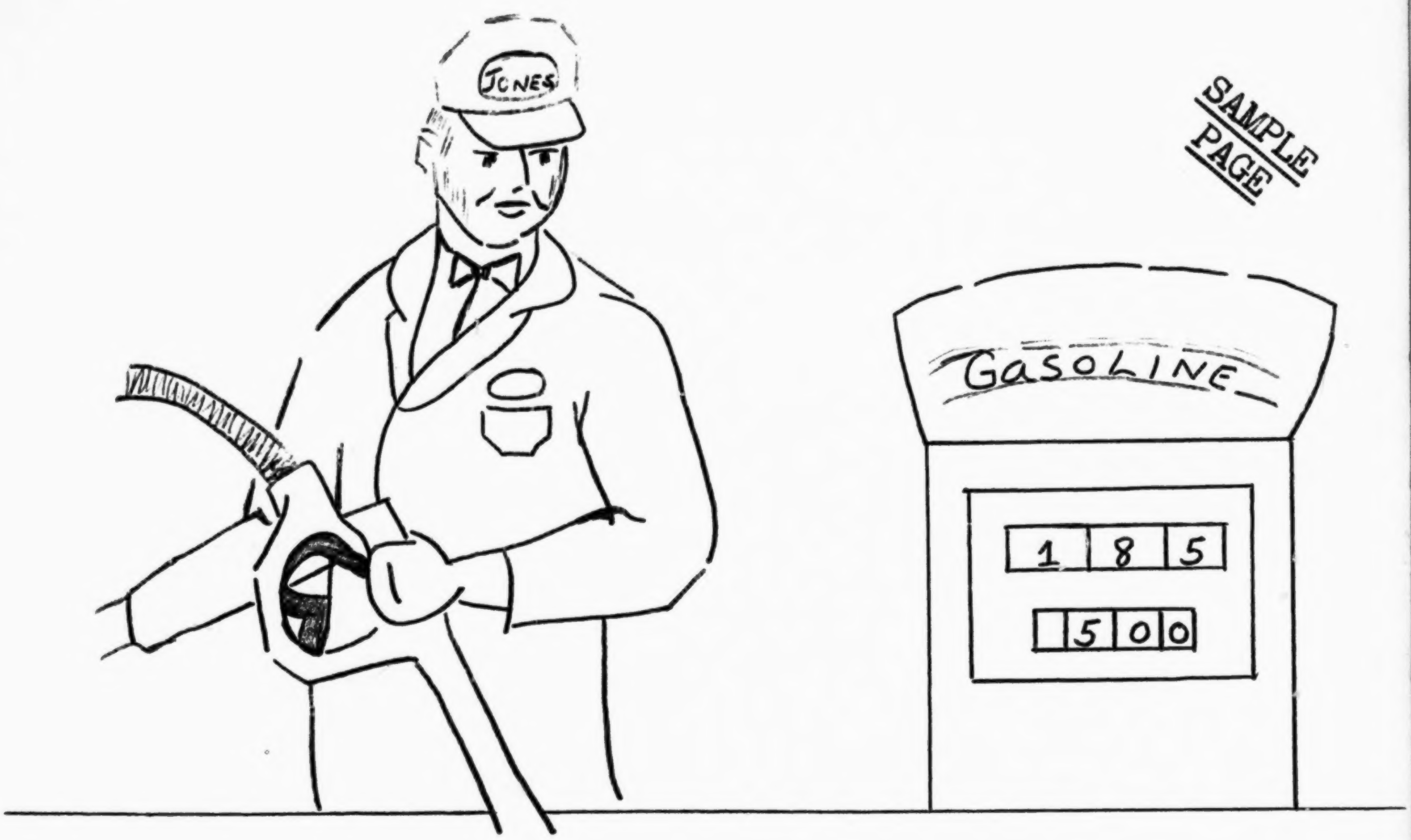
The Procedure - The A-V-K technique is not intended as a replacement procedure for regular classroom instruction which is ordinarily provided by a teacher. Indeed, the instructor is a vital component of the lesson unit and provides a good deal of concurrent support to the mentally retarded student in A-V-K programming. As emphasized throughout the report, teacher support is an important factor in working with the mentally retarded, especially in the early stages of their educational and vocational training.

Slow or reluctant learners respond enthusiastically during the lesson unit under study, to a projectual showing questions related to measurement which is projected on a screen by an overhead projector.

The A-V-K programs may be used to complement the classroom instruction and to reinforce concepts covered in class. The teacher plays the pre-recorded lesson tape which the student hears through the earphones connected to the tape recorder. He simultaneously views the projected material on the screen while listening to the tape; it has been noted that the use of earphones helps to reduce distractions during the lesson. He also handles the "props" related to the lesson which are on his desk, as directed by the instructions on the tape. The student is required to do little reading on his own; the taped commentary which is synchronized with the program content is quite comprehensive and any required written material may be projected on the screen during the course of the lesson or as a review activity.

Instruction booklets on: "How to Use A-V-K Programs; Suggestions for Classroom Use" and "How to Prepare A-V-K Programs" have been prepared by members of the project staff and distributed on a limited basis.

A sample frame from the A-V-K program on "A Gas Station Attendant" follows.



SAMPLE PAGE

"But how does George know how much gas he is giving to the customer? Look at the picture on the screen. George watches the front of the gas pump to see how much gas he is giving to the customer. Here is a picture of the front of the gas pump. See the numbers showing on the front of the gas pump? The numbers are one, eight, five. One and eight stand for "eighteen gallons of gas. But what does the five stand for?"

Sample of A-V-K "frame" and coordinated taped commentary.

There is reproduced below a segment of a taped lesson coordinated with pictures shown on a screen by the opaque projector. The program unit describes the work environment and the functional tasks of a dishwasher. The class has already completed a project related to ways and means of seeking employment. In the beginning of this unit, the teacher projected a "help wanted" ad.

Picture (Help Wanted A) - The tape at this point discusses the qualifications of a dishwasher and discusses the pay he might receive.

Picture (Sink) - The taped commentary proceeds to discuss where a dishwasher might find work and what the place of employment might look like.

The teacher uses a pointer to highlight the items under discussion as projected on the screen.

Picture (Dishwasher's Tools) - The student is also provided with "props", samples of the described items which he may handle, as directed by the taped instructions.

Tape - The students hear the following:

"What are some of the tools a dishwasher needs to do his job? He needs a wire brush and soft brushes for scraping bits of food off the dirty dishes. This is the wire brush and those are the soft brushes."

"He needs soap to make good soapsuds for washing the dishes. Here is a box of soap."

"Sometimes food burns and sticks on pots and pans. Then the dishwasher needs steel wool to rub off these spots. I am pointing to the steel wool pads."

"The dishwasher sometimes needs dish towels to wipe water off the dishes and to dry the counter tops."

"A wire brush and a pad of steel wool have been placed on your desk. Find the brush and then find the steel wool. Feel how rough it is."

"Does the dishwasher need any other kinds of tools?"

"Yes, he also uses a broom and a mop."

Picture (Brooms and Mops)

Tape - The students continue to hear the following:

"Now, why would a dishwasher use a broom and a mop?"

"Well, while he was washing the dishes, some food may have fallen on the floor and some water and soapsuds may have spilled on the floor, too."

"So the dishwasher first uses a broom to sweep up the dirt and then a mop to wash the floor clean. Here are two kinds of brooms and this is a mop."

When the recorded lesson is finished, several methods may be used to assess how much the student has learned. Again, the ingenuity of the teacher is of major importance; students may be provided with a worksheet, actually a short review and multiple choice quiz, which can be employed in a simple testing procedure. Each question on the sheet is flashed on the screen and the student is asked to select and encircle the best of the three answers accompanying the question. Following this, the correct answer is flashed on the screen for reinforcement of learning.

Some teachers may ask the students to remove their earphones and as the question is flashed on the screen, it is read aloud by the teacher or by the students taking turns, depending upon the ability level of the group, the emotional "climate" of the classroom, etc. The student gives the answer orally. Again, the correct answer is flashed on the screen and the student then encircles the correct answer on the sheet for reinforcement.

The A-V-K programs include an orientation to a variety of jobs that seem promising for mental retardates and are available in most cities and towns. Programs providing information on unskilled jobs include:

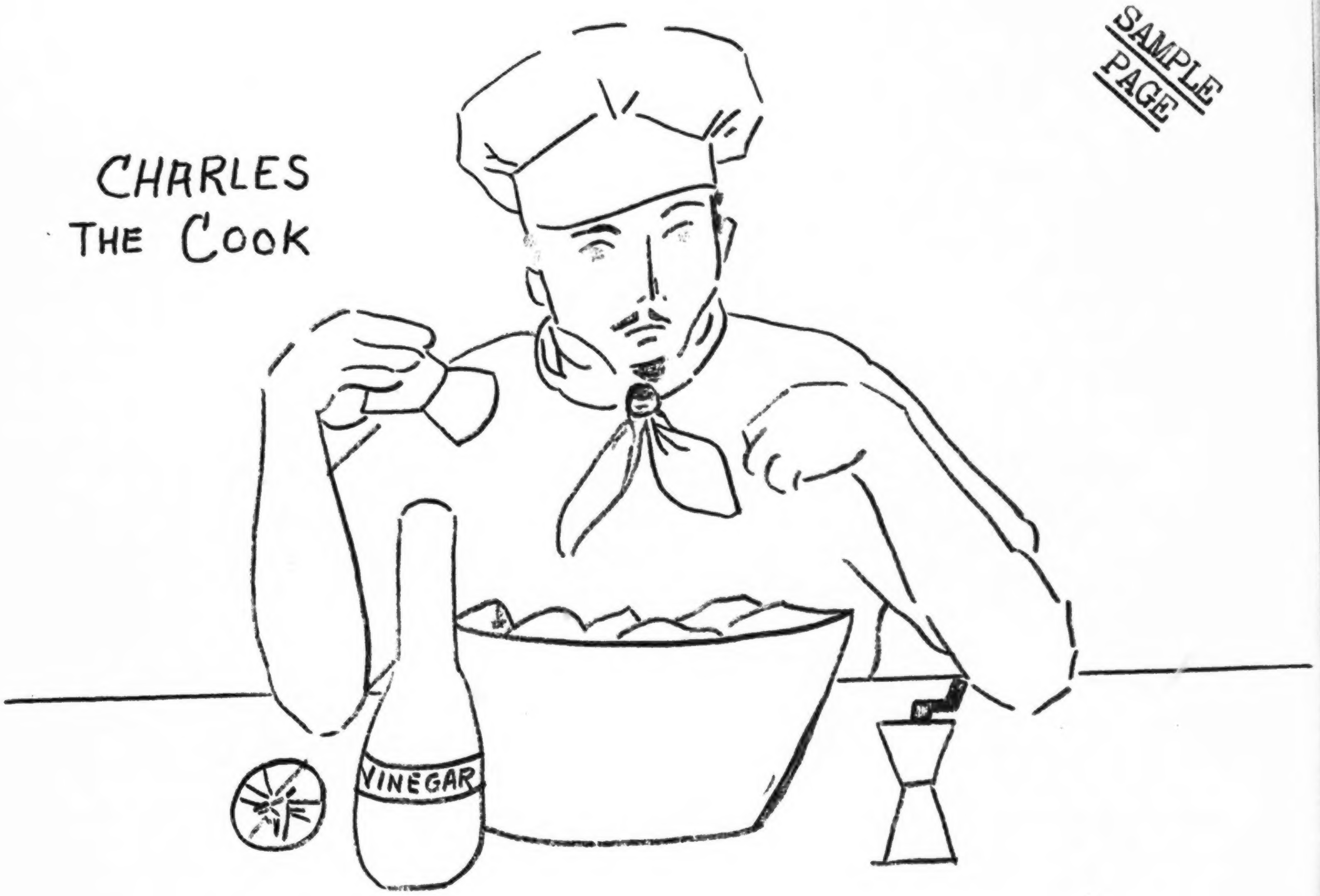
Cook's Helper - Introduction to employment in a commercial kitchen; the requirements of the job, salary and working hours, a day in the kitchen, vocabulary related to the job.

Laundry Helper - General description of jobs in a commercial laundry, the routeman, the sorter, the washing machine helper, receiver, feeder, ironer, wrapper and shipping room clerk and other jobs that could be handled by a mental retardate.

Dishwasher - Dishwashing in a commercial kitchen which does not use a mechanical dishwasher; requirements of the job, "tools" of the dishwasher; signs which may be found in a kitchen; washing dishes, silverware, pots and pans.

Sample frames from the A-V-K programmed units on the Cook's Helper follow.

SAMPLE PAGE



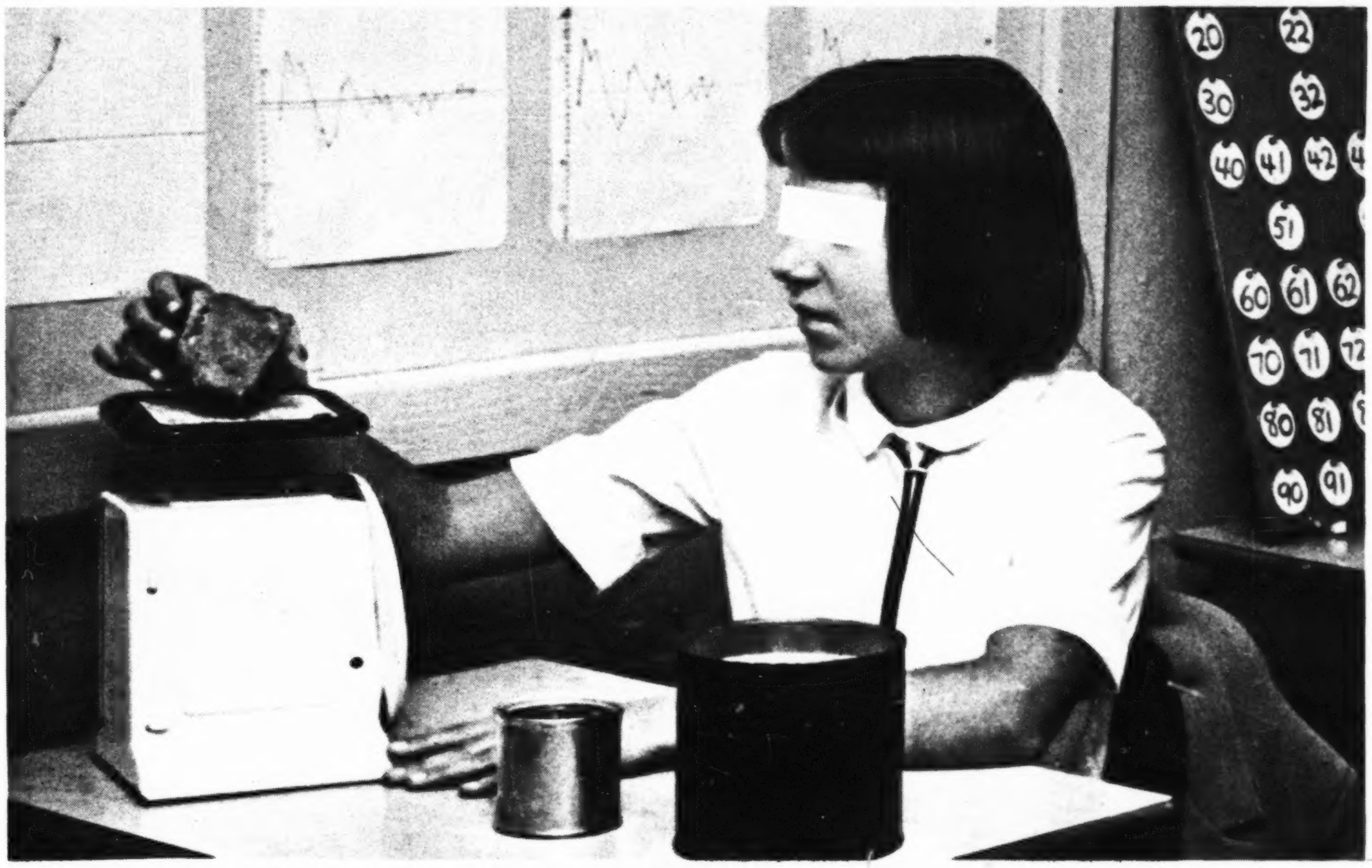
"Who makes the food for the hungry customers who come to the restaurant? It is the job of the cook to make the food for the hungry customers. Charles is a cook at Brown's Restaurant. Do you see the picture of Charles, the cook, on the screen? He needs a helper because he must cook for hundreds of people who come to Brown's Restaurant for a delicious meal. Charles's boss, Mr. Brown, hires Dick to be the Cook's Helper."

Sample of A-V-K "frame" and coordinated taped commentary.

Since the A-V-K programs require little or no reading, they offer a great deal to the student with reading problems who may be more skilled in performance and manipulative areas than he is in verbal areas. Other programs which have been well received by the mentally retarded students in the automated teaching aids project are:

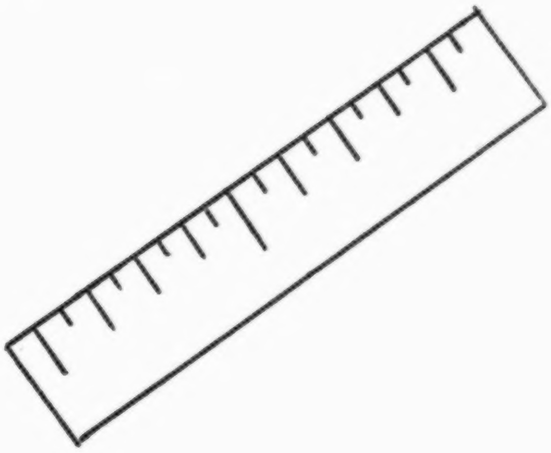
> Measuring in the Kitchen - Introduction to measuring in the kitchen; teaspoon and 1/2 teaspoon, measuring cup; simple fractions related to measurement in the kitchen are illustrated.
>
> Gas Station Attendant - General orientation to basic tasks in a gas station; duties of the gas station attendant, selling gas, washing a car, mopping the floor and keeping work area clean.
>
> Setting a Table for Breakfast - A practice unit which can be used in a training program related to jobs in the food services.

Several A-V-K programs have been tried out in public school special education classes of students with retarded mental development as well as with a group of young adult retardates in residence at Devereux Schools. The findings obtained during development and testing of the programs have been every encouraging, both in terms of feedback from the students, and in the enthusiasm shown by the special education teachers who have used the A-V-K programs. The opportunity to respond and to function on an individual basis in a group learning situation, together with the teacher's support, as needed, helps to establish a base for more independent thinking and doing later on, as the student gains in self-confidence and in knowledge related to the world-of-work.



Working independently during practicum on measurement following A-V-K program related to this subject.

RESEARCH HIGHLIGHTS



$$\sigma = \sqrt{\frac{\Sigma x^2}{N} - \bar{X}^2}$$

This section deals with two phases of research conducted to determine the effectiveness of automated vocational programmed instruction with mentally retarded and/or emotionally disturbed adolescents. Part A reports on preliminary testing of materials with several different student groups. Each auto instructional device discussed in Section III through VIII was utilized with the exception of the Learn-Ease and the Car-Tap Teaching Device. Part B reports on field test studies utilizing only the Model 50 Teaching Aid. Part C integrates the findings.

PART A

PRELIMINARY FIELD TESTING - For the most part teenager students enrolled at The Devereu Schools were utilized in developmental testing and in the preliminary field testing. Although preliminary field testing was also conducted at The Devereux Schools it was decided that Devereux students, while appropriate subjects for studies evaluating the effectiveness of the programmed instructional material, had already been exposed to much of this material during the course of such testing. It was felt that this prior exposure to the material would confound experimental results through an inability to control for task variables. Furthermore, it was noted that teachers, school principal and the students who had previously cooperated during the developmental and preliminar field testing were reluctant to continue in further prolonged studies feeling that a good deal of their time had already gone into the project over a three-year period.

Arrangements were made to conduct field testing of selected Model 50 programs at nearb residential institutions and public school special classes serving the mentally retard that, on the whole, have comparable student populations to those at The Devereux Schools. Moreover, it was possible to utilize students at these facilities which had no prior experience with the instructional materials under study.

Considerable time and effort was expended in planning for and in actually carrying out the off-campus field testing activities at the cooperating facilities which typically involved:

a. Evaluation of the institution's interest in a cooperative research venture.

b. Personal contacts with administration and staff as to project purposes.

c. Mutual planning (included time, student, and teacher factors.)

d. Inservice training of teachers to conduct controlled studies.

e. Transportation of the programmed units and equipment.

f. Supervision of research.

g. Presentation of research highlights to the participating installation.

Procedures Employed - Pre and post-tests on several programs were prepared and used with varied groups of mentally retarded and/or emotionally disturbed adolescent boys and girls enrolled in the vocational rehabilitation units of The Devereux Schools in Pennsylvania, as well as the outside facilities with a comparable population. All were slow learners ranging in ages between 13 and 20 years with an I.Q. range of 51 to 90. These groups received instruction in subject matter related to vocational training areas utilizing four techniques which are defined as follows:

a. Automated method refers to a procedure where teacher function is to guide students in the use of the auto-instructional device, supervise classroom activity and encourage continuence. The teacher maintains a record of student progress and organizes each session so that each student proceeds from the point he left off at the previous session. Each student is observed to see that he is operating the machine properly and is not running into mechanical difficulty. If a student seemed to be proceeding with difficulty, the teacher would instruct him according to need; such instruction was designed to be minimal. No formal classroom lesson was taught.

b. Conventional method refers to a technique where teacher function is to present material using proven approaches such as lecture, discussion, demonstration. No use is made of auto-instructional devices. The teacher is responsible for planning the lesson.

c. Integrated method refers to a technique wherein the teacher employs auto-instructional devices with programmed vocational material in addition to utilizing proven teaching approaches. When this method was employed, the following standardized sequence was followed:

    1. Lecture and/or demonstration.

    2. Use of the machine to stabilize concepts introduced (usually two to four pages were covered with the machine.)

    3. Discussion centered around what has just been covered.

    4. Pacing standards were set. The students proceeded at a prearranged pace.

d. Programmed lecture approach refers to a method which deviates from conventional procedures through teacher use of prepared lecture materials. In contrast to the conventional teaching methods as outlined in (b) above, these materials follow the same sequential steps and content outlined in the programmed vocational instructional units.

Orientation for Teacher Participants - In-service training was provided for select teachers of the cooperating institutions as well as for the Devereux teachers. Training included orienting instructors to the background, development, standard nomenclature and instruction on the use of the Teaching Aid. Learning theory was discussed as it applied to the classroom situation. In lining up the Model 50 studies, tape recordings of courses previously taught by teachers using the Model 50 were played and discussed. Making use of this background, the instructors then received practice in the use of the teaching aid while a member of the project staff observed them and acted as a consultant. Feelings and reactions reflected by the teachers toward the machine were discussed. This preparation served to standardize the procedure and to reduce teacher anxieties in the use of the teaching aid and the prepared programs.

Orientation for Students - An orientation period was also provided for students who acted as subjects. Orientation varied from method group to method group. Conventional and programmed lecture groups were introduced to the content areas to be covered. A format was developed to show students how knowledge in the area under study could be of benefit to them. Also discussed was how the teaching aid could help in the learning process. After initial structuring the students had discussions with the teacher acting as moderator. The same procedure was followed for both automated and integrated groups. The major difference was the introduction of the teaching aid into the orientation sessions in the following manner:

a. Students were given a machine and allowed to experiment with it and to discover as much about it as they desired.

b. The student was provided with an opportunity to become familiar with the standard nomenclature related to the machine; the focus was on student self-discovery.

c. Sample programmed material was introduced. Students learned to use the teaching device with the programmed units prepared for use with it.

Auto-instructional devices used in the studies included:

1. The Devereux Model 50 Teaching Aid
2. The Mast Teaching Machine
3. The Graflex Audio-Graphic Instructor
4. The A-V-K Unit

It should be noted that the following two additional auto-instructional techniques were evolved during the course of the field testing:

1. The Learn-Ease Teaching Device - this is described in Section IV and is a non-machine adaptation of the Model 50.
2. The Car-Tap Unit - this is described in Section VII and is essentially an adaptation of the equipment utilized in the Graflex Audio-Graphic Instructor.

Although several programmed instructional units were prepared for the Learn-Ease from Model 50 programs and developmental testing was conducted with these units, time did not permit the inclusion of the Learn-Ease programs in the field testing program. The Car-Tap technique evolved shortly before the termination of the project itself; consequently there wasn't sufficient time to prepare programmed units for use with this technique. Limited experimentation with the Car-Tap utilizing programmed materials designed originally for the Graflex indicates that it has considerable merit for further exploration and development.

Preliminary Field Studies - A number of field studies were conducted which focused upon evaluating program effectiveness using different methods of presentation. It was not our intent to pit the teacher against the machine; rather, more efficient ways were sought to aid special class teachers to develop a learning atmosphere using auto-instructional programmed vocational materials.

Basic experimental design, for the most part, included a comparison of the effect of different techniques, i.e., the automated, conventional, integrated and programmed lecture approach, as described on page IX-1, in performance of mentally retarded or emotionally handicapped adolescents. In most cases equated groups were used; occasionally, this was neither possible or desirable. When equated groups were not employed, studies dealt with "life-centered" situations and the methods were evaluated using classes for educable mentally retarded students.

Several studies have been reported at various conventions and special meetings of national professional groups, i.e., APA, APGA, AAMD. (See Section X for a detailed listing of these conferences where highlights of the project were shared with members of the profession.) In the pages that follow, the findings obtained in current investigations are integrated with the earlier research in developmental sequence.

Several studies were conducted which involved the development of skills in filling out job application forms and in applying for a job. Two of these were prepared for use on the Model 50 Teaching Aid; two others utilized the Mast Teaching Machine and another study on "Applying for a Job" was prepared for use on the Graflex Audio-Graphic Instructor. The highlights of the studies are reported below.

Program for the Model 50 Teaching Aid - A lesson on job responsibilities was prepared for conventional instruction as well as for use with the Model 50 Teaching Aid. This program included explanations of abbreviations used in help wanted ads in newspapers. It also contained a discussion of work habits. There was included information related to employment procedures, as for example, the filling out of employment forms, explanation of wage deductions and other essential job information. The content was designed to acquaint the student with common employment practices in industry and to help minimize the fear of job hunting, by reducing the "unknown" in applying for a job.

Fifty slow learners in classes ranging from the 5th to 11th grade levels, were given a pre-test on the subject. From this group of subjects, twenty students who were most nearly matched on the variables of sex, age, class level, I.Q., and pre-test scores, were randomly assigned to one of 2 classes. One teacher was responsible for both groups. One class was instructed using a conventional approach. The second, by an automated approach. Both groups met for one hour for five consecutive days. Individuals in the automated method group were allowed to proceed at their own pace, while the students in the conventional group were paced by the teacher.

The results demonstrated that the group taught by the automated method showed a 54% gain over the group taught by conventional methods. The greatest gains were made by students with I.Q.'s in the middle and lower ranges. Least gains were made by students with I.Q.'s in the higher ranges. The greatest gains were found at the fifth grade level for the conventional group. Little improvement was demonstrated at 7th and 11th grade levels. With the automated methods group, greatest gains were made between 7th and 9th grade levels.

A second study using the Model 50 job responsibilities programmed instructional program was conducted with a group of 12 adolescents who had a mean I.Q. of 79, and a chronological age of 16 years, 6 months. The experiment was designed to evaluate three classroom procedures: (1) using a teacher along with programmed instruction; (2) the teacher and conventional classroom teaching methods; and (3) programmed instruction alone.

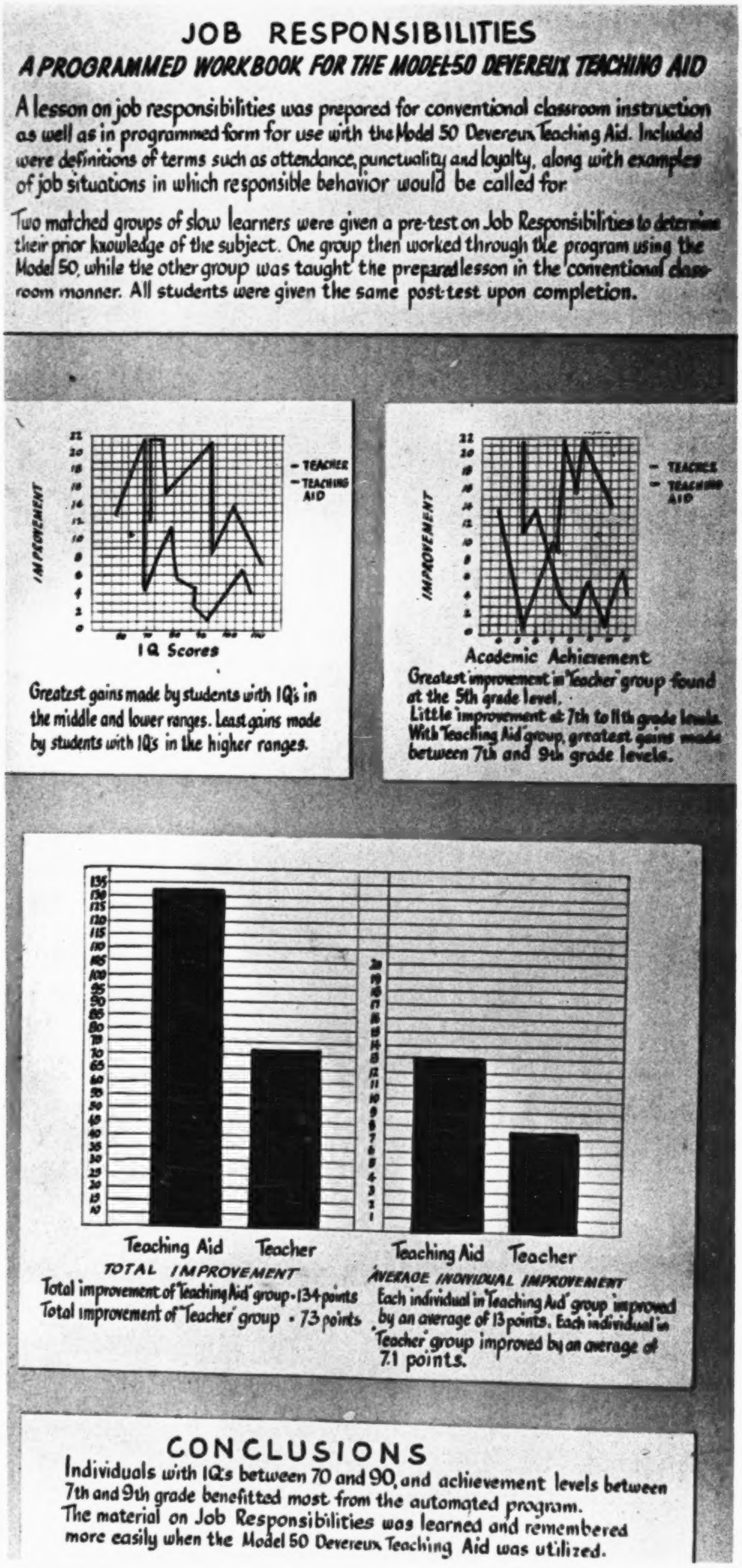
Three books in the series "Job Responsibilities" were selected on the basis of pre-test scores made by the subject as well as on the basis of a pre-determined level of difficulty of the frames in each book. In this instance, we were equating the material rather than the subjects. Having equated the material on the basis of difficulty level and the amount of information the experimental subjects had in each area, it was then possible to use the same population with the three procedures, using a different set of instructional material for each.

The findings showed a significant gain between the pre and post-test results at the .05 level, for that procedure where the teacher applying conventional teaching methods was used. Where the Model 50 Program was used by itself, no statistically significant gains were realized. However, when the teacher and programmed instruction were used, gains were at the .01 level.

A display board summarizing findings obtained on the study on Job Responsibilities utilizing the Model 50 Teaching Aid appears on the next page.

The Mast Teaching Machine was used with two matched groups of slow learners who were given fictitious biographical data and told to use it to fill out a standard job application from. One group was given one hour of teacher instruction in the proper way to complete the form while the other group worked independently with the Mast Teaching Aid. Both groups showed significant performance gain from pre to post-tests. Differences in post-test means were slight and not statistically significant.

A second study utilizing the Mast Teaching Machine with a job application program was conducted using a group of 30 mildly retarded teenagers. Subjects were randomly assigned to one of two treatment groups. One group was taught by a classroom teacher along with the Mast Teaching Machine. The second group had the same teacher who used conventional methods in her classroom presentation.



JOB RESPONSIBILITIES

A PROGRAMMED WORKBOOK FOR THE MODEL-50 DEVEREUX TEACHING AID

A lesson on job responsibilities was prepared for conventional classroom instruction as well as in programmed form for use with the Model 50 Devereux Teaching Aid. Included were definitions of terms such as attendance, punctuality and loyalty, along with examples of job situations in which responsible behavior would be called for.

Two matched groups of slow learners were given a pre-test on Job Responsibilities to determine their prior knowledge of the subject. One group then worked through the program using the Model 50, while the other group was taught the prepared lesson in the conventional classroom manner. All students were given the same post-test upon completion.

Greatest gains made by students with IQ's in the middle and lower ranges. Least gains made by students with IQ's in the higher ranges.

Greatest improvement in "Teacher" group found at the 5th grade level.
Little improvement at 7th to 11th grade levels.
With "Teaching Aid" group, greatest gains made between 7th and 9th grade levels.

TOTAL IMPROVEMENT

Total improvement of "Teaching Aid" group - 134 points
Total improvement of "Teacher" group - 73 points

AVERAGE INDIVIDUAL IMPROVEMENT

Each individual in "Teaching Aid" group improved by an average of 13 points. Each individual in "Teacher" group improved by an average of 7.1 points.

CONCLUSIONS

Individuals with IQ's between 70 and 90, and achievement levels between 7th and 9th grade benefitted most from the automated program.
The material on Job Responsibilities was learned and remembered more easily when the Model 50 Devereux Teaching Aid was utilized.

Section of Model 50 exhibit at a professional meeting summarizing findings obtained in the study on Job Responsibilities

Both groups were tested on filling out a job application before and after the experiment. No statistically significant differences were found between group gain score means. In a comparison of the differences between the pre and post-tests, performance gain was significant at the .05 level in favor of the experimental group.

However, of greater importance, was the fact that in handling simulated job problems, as encountered in a group guidance program, the experimental group was better able to fill out job application forms. Also, to deal with questions in oral interviews as they came up in role-playing experiences, and in actual applied work situations in the community.

The group guidance sessions referred to above, were very helpful to the students and to the investigators evaluating the Mast programs. Subjects were randomly assigned to one of two group guidance sections. The counselor for both groups had no prior knowledge as to which treatment conditions the subjects in the group had been exposed. He was asked to rank the subjects using a method of paired comparisons (each subject was compared to every other subject) on their ability to fill out job application forms and to deal with questions in oral interviews during role-playing experiences. Students were ranked from highest to lowest in each of the two group guidance sections, for each of the two variables.

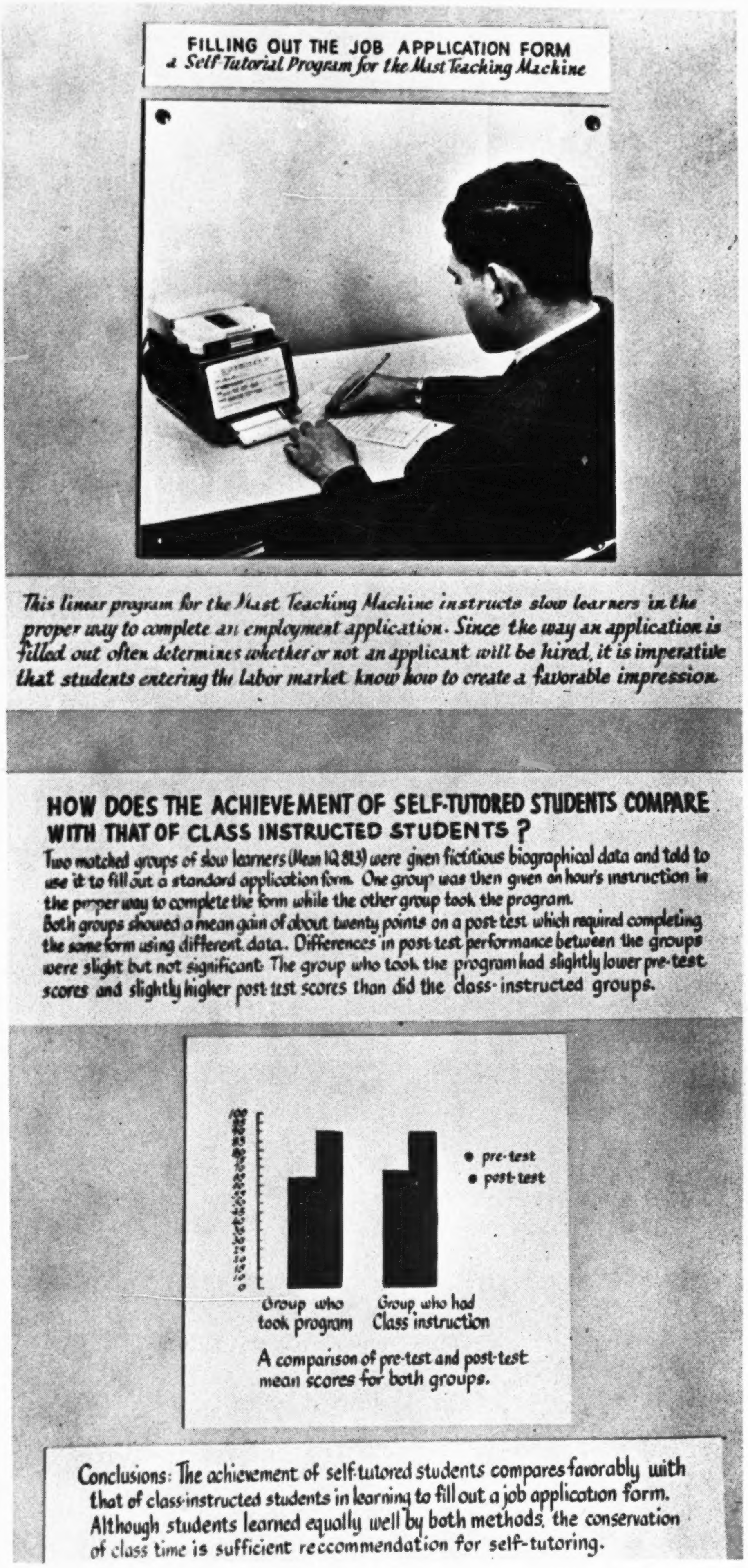
Results indicate that the group taught by the teacher using the Mast Teaching Machine to supplement his lecture ranked higher at the .05 level than did the conventional group in one of the group guidance sections. No differences were found between group ranks in number two section. No statistically significant differences were found between groups in their ability to deal with questions in oral interviews - the trend in both cases was in favor of greater proficiency on the part of the integrated method groups, in the role-playing situation.

Results are not consistently in favor of the integrative method which utilizes the auto-instructional device and programmed lesson units along with the proven teaching methods. The same trend was evident in ratings obtained from observations in a group guidance session. No significant differences were found between treatment conditions with the exception of one integrative method group demonstrating greater proficiency in filling out job applications in but one of the group guidance sessions.

Ratings on student ability to deal with questions in an oral interview were subjective and dependent upon the observations of one person, the group leader. More sensitive measures could be devised. For example, several raters could observe group process from behind a two way mirror with sound piped into their observation room. Using a method of paired comparisons based upon a specific criteria, ambiguity in ratings could be reduced.

The Mast program is heavily reliant upon verbal content and constructed responses. Students were able to profit from a program of this sort, although it could be predicted that retardates would profit more from a less verbally oriented program . Writing out answers may account for the results. Material equated so that the vocabulary level was commensurate with student ability and/or the novelty effect of using a new device may also account for positive findings.

A section of a Mast exhibit at a professional meeting summarizing findings obtained in a programmed unit - Filling Out the Job Application Form follows.



FILLING OUT THE JOB APPLICATION FORM
a Self-Tutorial Program for the Mast Teaching Machine

This linear program for the Mast Teaching Machine instructs slow learners in the proper way to complete an employment application. Since the way an application is filled out often determines whether or not an applicant will be hired, it is imperative that students entering the labor market know how to create a favorable impression.

HOW DOES THE ACHIEVEMENT OF SELF-TUTORED STUDENTS COMPARE WITH THAT OF CLASS INSTRUCTED STUDENTS ?

Two matched groups of slow learners (Mean IQ 81.3) were given fictitious biographical data and told to use it to fill out a standard application form. One group was then given an hour's instruction in the proper way to complete the form while the other group took the program.

Both groups showed a mean gain of about twenty points on a post-test which required completing the same form using different data. Differences in post-test performance between the groups were slight but not significant. The group who took the program had slightly lower pre-test scores and slightly higher post-test scores than did the class-instructed groups.

A comparison of pre-test and post-test mean scores for both groups.

Conclusions: The achievement of self-tutored students compares favorably with that of class-instructed students in learning to fill out a job application form. Although students learned equally well by both methods, the conservation of class time is sufficient reccommendation for self-tutoring.

Display board summarizing findings obtained in the Mast study on Filling Out the Job Application Form

The Graflex Audio-Graphic Instructor - Two studies were conducted using the Graflex programmed unit on "Applying for a Job."

The subjects for the first evaluation were a sample of 40 students drawn from a residential population of mildly retarded adolescents. The procedure was similar to that employed with the second investigation reported with the Mast Teaching Aid (see page IX-7).

Results indicated the students in the experimental group learned significantly more and were also better able to deal with job interviews, both in role-playing and in applied practical situations involving cooperating employers who ranked the students on their performance in an initial job interview.

In the second study the Graflex Audio-Graphic Teaching Device was used with one of two matched groups of slow learners. The second group was taught by conventional methods. Both groups attended classes covering the topic of how to apply for a job. Each group was pre-tested and tested at the conclusion of the lesson on the content covered.

Students who received programmed instruction with the Graflex made greater gains (as measured by the difference between pre-tested and post-test scores) and reached higher levels of achievement than did those students taught by conventional methods. The difference was statistically significant at the .01 level (t=3.4 df 38). It appears that the combination of auditory and visual stimuli, as presented by the teaching device, facilitates learning of this type of material by students observed in the study.

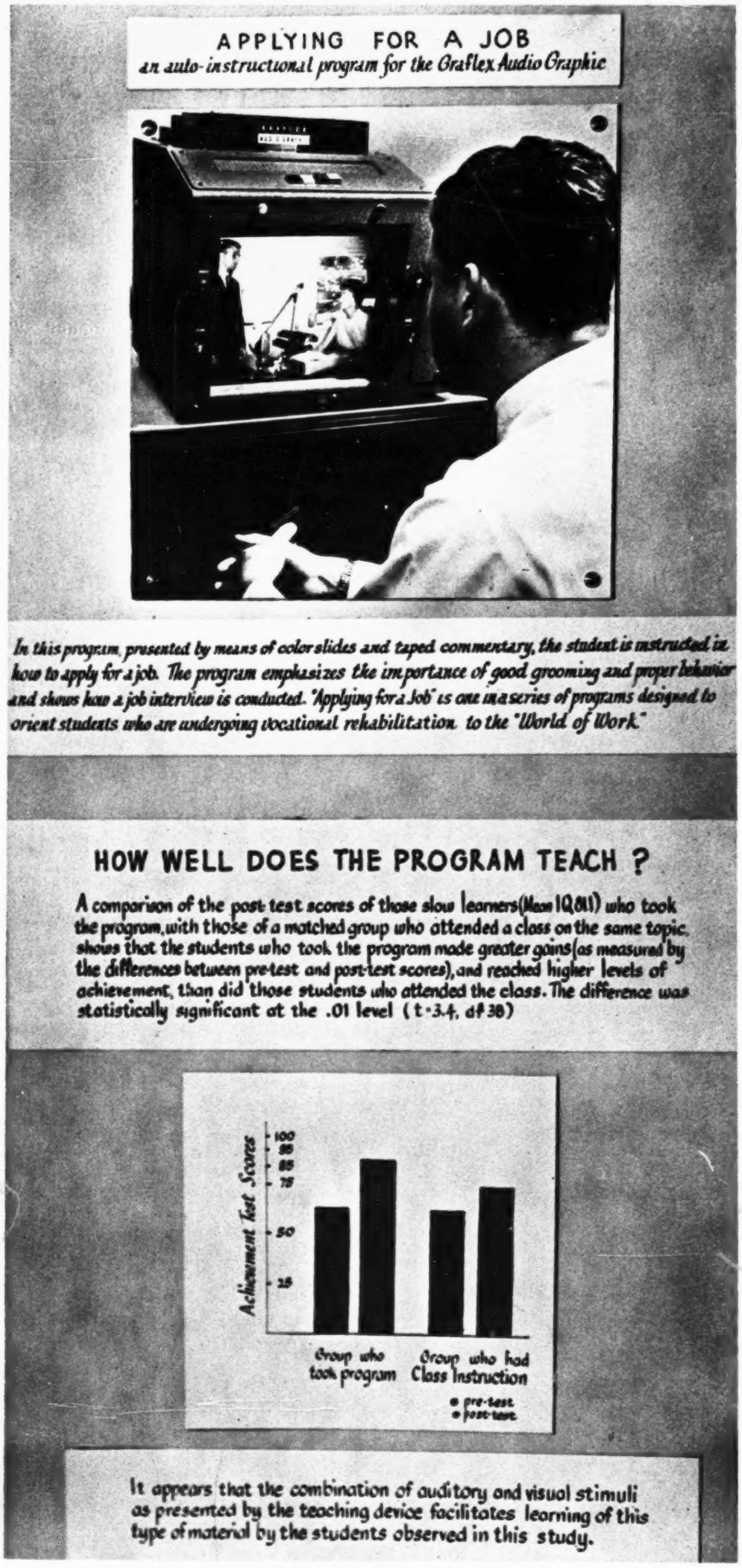
A panel display of the Graflex exhibit summarizing the findings on the study, "Applying for a Job" follows on the next page.

Graflex Study on TOWER System Program - A study involving the use of a programmed version of the TOWER test, "Electronics Assembly" (this program is described in Section VI-9) was conducted utilizing the Graflex Instructor. The "Electronics Assembly" program consists of ten subtests and assesses a student's ability in the area of electronics, e.g. learning color code, running wires, inspecting the job, tying knots, running a cable harness, lacing, measuring wires, stripping wires, and tinning wires.

Ten mentally retarded adolescents drawn from a Devereux residential, pre-vocational unit were used as subjects. The design required that half of the group be evaluated on the Graflex version of the test while the other half were administered the test in the regular manner. (The regular procedure involves a good deal more of the evaluator devoting his time to the subject in explaining the instructions and assisting in any difficult steps.)

The students were rated on two measures - quality and performance. The latter refers to the amount of work completed and the former to the quality of the finished product. Each measure was scored a five point scale ranging from a low of 1 up to a high of 5. No statistically significant differences between the groups was found. It should be noted that the Graflex method resulted in a saving of time for administration, thereby freeing the teacher for intensive guidance of indicated students. It is felt that the Graflex method of administration of the TOWER tests may be considered worthy of further exploration as an aide in conducting diagnostic vocational evaluations.

Chart #1 giving a description of quality and performance scores for the programmed instruction and regular method group on the TOWER System appears on page IX-10.



APPLYING FOR A JOB

an auto-instructional program for the Graflex Audio Graphic

In this program, presented by means of color slides and taped commentary, the student is instructed in how to apply for a job. The program emphasizes the importance of good grooming and proper behavior and shows how a job interview is conducted. "Applying for a Job" is one in a series of programs designed to orient students who are undergoing vocational rehabilitation to the "World of Work."

HOW WELL DOES THE PROGRAM TEACH ?

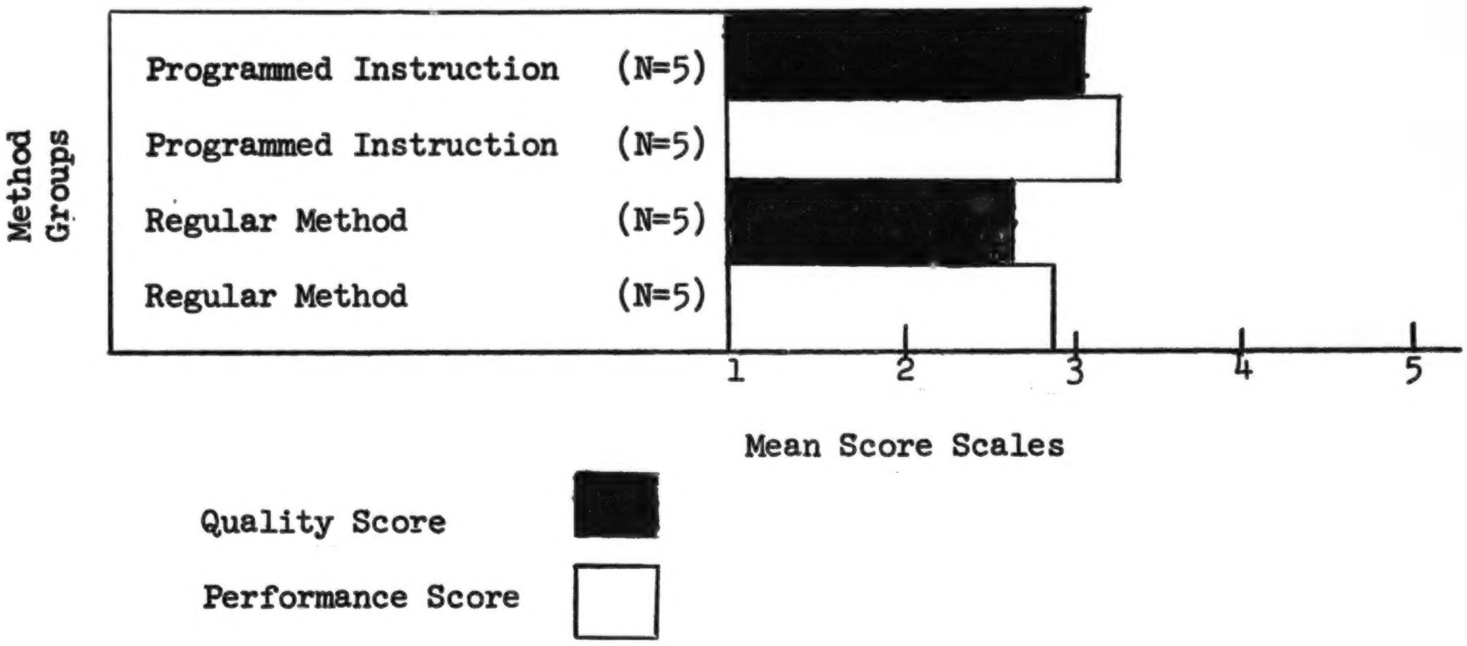
A comparison of the post-test scores of those slow learners (Mean IQ 81) who took the program, with those of a matched group who attended a class on the same topic, shows that the students who took the program made greater gains (as measured by the differences between pre-test and post-test scores), and reached higher levels of achievement, than did those students who attended the class. The difference was statistically significant at the .01 level (t = 3.4, df 38)

It appears that the combination of auditory and visual stimuli as presented by the teaching device facilitates learning of this type of material by the students observed in this study.

Section of Graflex Exhibit on Display at a Professional Meeting

Chart #1

A description of Quality and Performance Scores for Programmed Instruction and Regular Method groups in the TOWER System.



Studies Utilizing the A-V-K Technique - An A-V-K lesson unit on "Measuring in the Kitchen" included an introduction to the operation of a commercial kitchen and an orientation to measuring, as used in the preparation of food. Both measuring spoons and cups were included in the instruction as "props" (Section VIII describes the A-V-K Technique.)

The subjects were 24 male and female adolescents drawn from a residential population of moderate to mild retardates. No difference was found between the groups on variables of age and intelligence. Both groups, in addition to classroom teaching, received instruction through use of the A-V-K Technique.

At the beginning and end of the classroom phase of the study, the students were administered a test consisting of two sub-tests: Part 1 - the theoretical aspects of measuring such as, where, when, and how to use the measuring cups and spoons; and Part 2 - a performance test which required the subjects to actually measure quantities of such items as salt, using the measuring utensils in a practicum situation.

The findings on pre and post-test scores related to Part I - the theoretical aspects of measuring, found no significant differences between the two groups. However, it was later observed that the instruction received from the classroom teacher along with automated instruction seemed to result in greater ease and a higher degree of success in a practical work situation. This factor is experimentally taken into account in the study which follows.

In a second investigation using the A-V-K program, "Measuring in the Kitchen," a group of moderately to mildly retarded male and female adolescent students were randomly assigned to two test situations. In addition to intellectual deficit, students in both groups mainfested emotional problems.

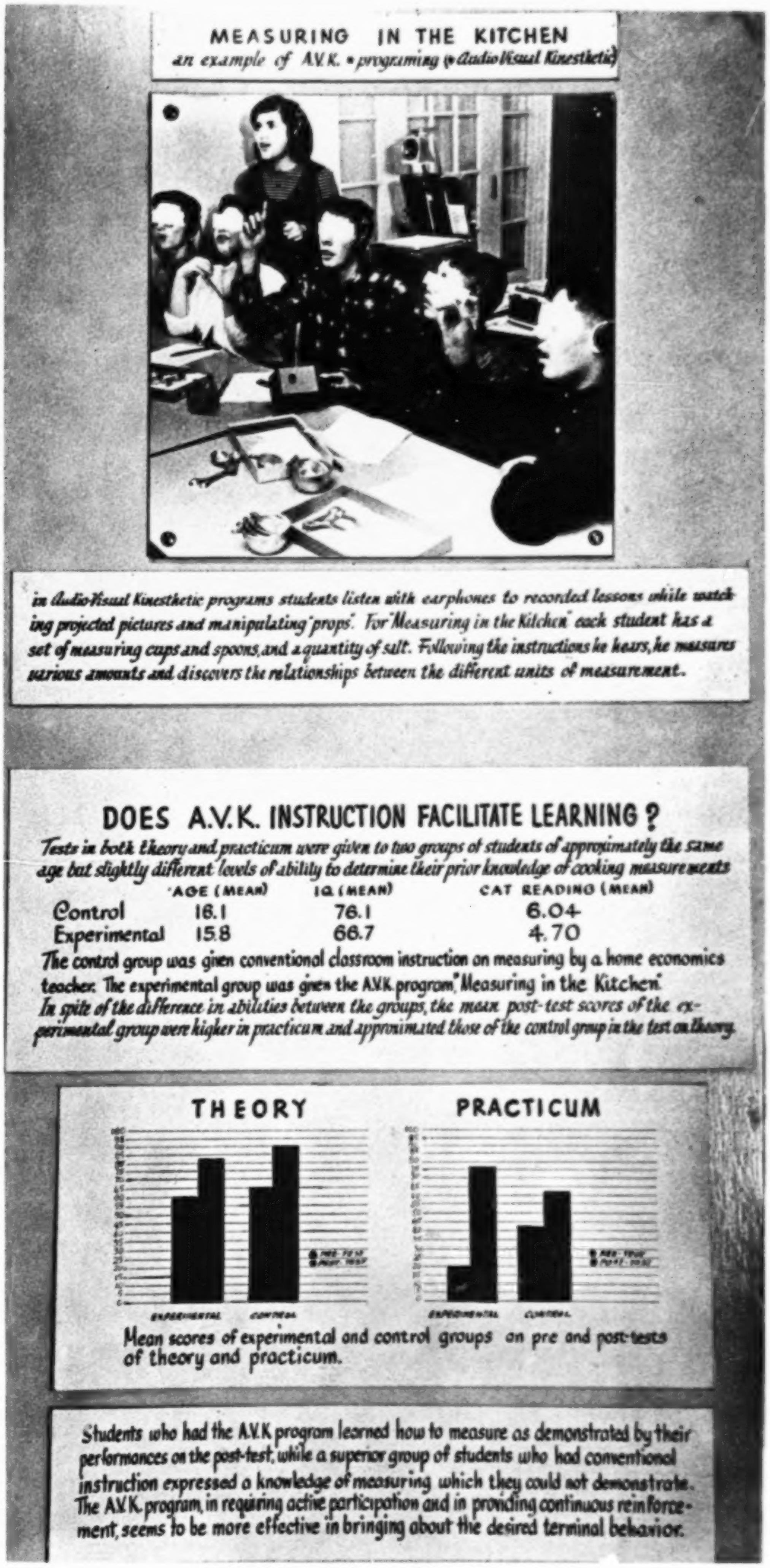
One teacher cooperated in teaching one group by an integrated method utilizing the auto-instructional devices encompassed in the A-V-K technique along with proven teaching approaches; the second group was taught by a conventional method with no use made of the automated teaching aids. Both groups were pre-tested on both the Part 1 and Part 2 subtests encompassing theoretical and practical aspects of measuring as discussed above.

The group of students taught by the conventional method scored significantly higher on the pre-test related to the theoretical aspects of measuring than did the group exposed to the integrated method. It should be noted that although both groups were of approximately the same age, the measured intellectual and reading level of the students in the "conventional method" group was higher than that of the other group.

Each class met for one 45-minute period for three successive days. On the 4th day, both groups were tested on the material that was covered in the study. Results showed that each group gained at a statistically significant level from pre to post-tests for both theory and practicum in measurement. No statistically significant differences were found between groups on the theoretical sub-tests. However, the "integrated method" group demonstrated a higher level of proficiency on the practicum sub-test when the post-test means were compared.

Results from the two A-V-K studies suggest that: (1) for both experimental conditions, each group in general learned theoretical material fairly well, whether it was taught by the conventional classroom method or the integrated method utilizing the automated devices encompassed in the A-V-K technique; (2) in a practical task-oriented situation, however, the group of students taught by means of the integrated approach, demonstrated greater proficiency in the practicum of handling of the assigned task with ease and facility in contrast to the students in the group taught by the conventional method. The latter group, although reflecting a knowledge of measuring on the theoretical level did not do as well in the task-oriented situation.

One possible explanation for the latter finding is that learning by the students to manipulate "props" through the integrated approach of the A-V-K technique provided positive transfer from the teaching to the practical task situation. This finding is consistent with the belief that retardates learn best by practical concrete tasks oriented to seeing and doing.



MEASURING IN THE KITCHEN

*an example of A.V.K. * programing (* Audio Visual Kinesthetic)*

in Audio-Visual Kinesthetic programs students listen with earphones to recorded lessons while watching projected pictures and manipulating "props". For "Measuring in the Kitchen" each student has a set of measuring cups and spoons, and a quantity of salt. Following the instructions he hears, he measures various amounts and discovers the relationships between the different units of measurement.

DOES A.V.K. INSTRUCTION FACILITATE LEARNING ?

Tests in both theory and practicum were given to two groups of students of approximately the same age but slightly different levels of ability to determine their prior knowledge of cooking measurements

	AGE (MEAN)	IQ (MEAN)	CAT READING (MEAN)
Control	16.1	76.1	6.04
Experimental	15.8	66.7	4.70

The control group was given conventional classroom instruction on measuring by a home economics teacher. The experimental group was given the A.V.K. program "Measuring in the Kitchen."

In spite of the difference in abilities between the groups, the mean post-test scores of the experimental group were higher in practicum and approximated those of the control group in the test on theory.

Mean scores of experimental and control groups on pre and post-tests of theory and practicum.

Students who had the A.V.K program learned how to measure as demonstrated by their performances on the post-test, while a superior group of students who had conventional instruction expressed a knowledge of measuring which they could not demonstrate. The A.V.K. program, in requiring active participation and in providing continuous reinforcement, seems to be more effective in bringing about the desired terminal behavior.

An Exhibit Summarizing Highlights of the early A-V-K Studies.

RESEARCH HIGHLIGHTS

PART B

FIELD TESTING - This section reports on highlights of findings obtained in representative field testing of certain Model 50 programmed units with students in the population under study.

JOB RESPONSIBILITIES - Two studies are reported using the Model 50 Teaching Aid to develop concepts concerning job responsibilities. The studies presented drew students from a variety of differing populations and utilized the services of certified special class teachers.

Study Number One - An investigation of program effectiveness on a Model 50 job responsibilities workbook series was conducted at a residential school for mentally retarded pre-adolescent and adolescent males and females. Subjects were randomly assigned to one of three treatment groups. One teacher taught each group using one of three different methods: programmed lecture, integrated, and automated approaches. The instructor was a certified special class teacher with ten years of experience.

In order to develop a skilled approach, the instructor practiced combining the Model 50 with classroom presentation. Proficiency with the integrative method came about as a result of testing out different ways of presentation with evening classes he was conducting for mentally retarded adult students employed in the outlying community. Practice sessions were observed by the investigator.

Procedure - An orientation period was conducted by the classroom teacher. Pre-testing was done during the first fifteen minutes of the orientation. It served as a jumping off point for discussion as well as providing actuarial data about the groups. Orientation was conducted independently for each group. This session was tape-recorded, as were following classroom sessions.

Excluding the orientation, each group met for four consecutive one-hour sessions. Groups met on the same days at the same hour. The automated group was allowed to proceed at their own pace. They could review material if they completed the program before the time limit. Both programmed lecture and integrated method groups were exposed to one quarter of the content of each session. Students were post-tested directly following their last class period.

Results - Data was analyzed using the Analysis of Covariance. Test of Significance of differences between the group Regression Coefficients demonstrated that the separate regression lines were not parallel and as such had significantly different slopes. A square root transformation ($\sqrt{x+.5}$) was used to help stabilize the data. Table IA gives the results of the analysis. It will be noted that no statistically significant differences were found between treatment groups. Pre- and post-test comparisons were calculated for each group.

Table 2A summarizes the results of the three comparisons. Here again there were no statistically significant differences found between pre-and post-test scores for the programmed lecture groups. Gain was significant at $p \angle .025$ for both automated and integrated method groups.

Results indicate that under both conditions when the Model 50 teaching was employed, significant performance was demonstrated. Results may be attributed to (a) the teaching aid facilitating learning; (b) novelty or Hawthorn effects; (c) opportunity for repetitive practice for students taught by the automated method.

Table IA

Analysis of Covariance for Job Responsibilities

Test Scores

SV (1)	SS (2)	df (3)	MS (4)	F (5)	P (6)
Treatments	.29	2	.145	1.02	N.S.
Error	2.42	17	.142		
Total	2.71	19			

Table 2A

A Comparison of Pre and Post-test mean Scores for Each Treatment Condition

	Pre-test		Post-test			
Group	Mean	SD	Mean	SD	t	P
Automated	8.86	2.94	12.57	2.45	2.36	.025
Integrated	6.43	2.87	9.85	2.26	2.32	.025
Programmed Lecture	7.57	2.33	10.14	3.65	1.45	N.S.

π =21

Study Number Two - A second investigation on the effectiveness of job responsibilities programmed instructional material for use with the Model 50 Teaching Aid was conducted at a residential treatment center for mentally retarded and/or emotionally disturbed pre-adolescent and adolescents of both sexes.

Procedure - Twenty-four male and female adolescent students between the ages of 14 and 19 were matched on pre-test scores. The test was administered thirty days before the study was to begin. Matching was accomplished by finding three students who were most nearly alike and then assigning each to one of three treatment blocks, then taking the next three, etcetera. Comparability of groups was calculated for the pre-tes scores as well as for variables of WAIS and WISC full scale I.Q., reading level, and age. Analysis of variance using a randomized groups design demonstrated no difference between groups.

In addition to evaluating program effectiveness, this investigation was designed as a pilot study to compare student performance under the different treatment conditions of automated, integrated, and programmed lecture approaches when teacher variable was not held constant but controlled on the basis of years of teaching experience and past performance.

Three certified special education teachers were the instructors in this study. Teacher A, considered the most effective, was assigned the programmed lecture group; Teacher B, the second most effective was assigned the integrated methods group; Teacher C was assigned the automated group. Criteria for assigning levels of effectiveness was staff ratings.

Teacher in-service training and student orientation was conducted by a staff psychologist at the institution. This procedure was essentially the same as that reported in the preceding study. The classroom teacher, however, was not involved in the orientation program.

Each group met three consecutive days for one hour per day. The automated group was allowed to proceed at their own pace. They could review material if they completed the program before the time limit. For the programmed lecture and integrated methods the teacher presented one third of the content each session. Groups were run concurrently. Students were post-tested directly following their last class period.

Results - Data were analyzed using an analysis of variance, randomized block design. No statistically significant differences were found between treatment groups. Table IB gives a description of this comparison.

Table IB

Analysis of Variance for Post-test Results

SV	SS	df	MS	F	P
Treatments	48.25	2	24.13	2.26	NS
Blocks	468.95	7	67.97		
Residual	149.92	14	10.67		
Total	661.62	23			

Pre- and post-test means comparisons were calculated for each treatment group. Table 2B gives a description of pre- to post-test comparisons.

Table 2B

A Comparison of Pre-Test and Post-test Error Mean Score for each Treatment Condition

	Mean	SD	Mean	SD	t	P
Automated	12.12	4.00	8.50	2.12	2.17	.025
Integrated	14.12	3.17	11.63	5.75	1.00	N.S.
Programmed Lecture	12.62	5.14	8.75	5.11	1.41	N.S.

Each group demonstrated mean error reduction from pre- to post-test. Gain was statistically significant for the automated method group ($p < .05$) but not for either the teacher-machine combination or for the Programmed Lecture group. There was a trend in the direction of significance for the Programmed Lecture group. The level of confidence, $p < .10$, is however, not reliable.

The results of this experiment using a program on job responsibilities suggests that: (1) for the condition where students used only the Model 50 Teaching Aid with an opportunity to review if time allowed, significant gain was demonstrated from pre- to post-testing; (2) results are inconclusive as to whether the use of the Model 50 Teaching Aid will help bring a lesser experienced teacher up to the performance level of a highly qualified and experienced instructor.

It must be pointed out that despite efforts to use matched groups for each treatment condition, the integrated method class was composed of a group of less stable and more disturbed individuals than either of the other two sections. It was originally thought that levels of pathology would be randomly distributed among the three groups. A post hoc check of clinical classification demonstrated categories were equally distributed. Severity of psychological deficit resulting from emotional factors apparently was not.

This difference between groups was detected by both the classroom teacher and staff psychologist after the study was already underway. Because of this factor, comparisons made with the integrative methods group cannot be considered reliable for this experiment.

Tool Recognition - A study which employed a Model 50 programmed unit on "Tool Recognition" was conducted at two cooperating junior high schools located in a town in Pennsylvania where the economy was predominately related to a large steel industry in the town. Three intact classes for educable mentally retarded students (E.M.R. classes) cooperated in this study.

Six programmed workbooks are encompassed in the Tool Recognition Program. The student is required to associate the name of a tool with a picture of a tool; he then makes a discrimination between this tool and others on the page like it. This particular program has the lowest verbal loading of any of the prepared Model 50 programs.

Procedure - Two special class teachers participated in this study. Three methods of instruction served as the independent variables. One teacher (Teacher A) taught two classes; one of these classes learned using the conventional method of approach and involved a group of 10 students; the second class taught by this teacher, consisted of 13 students, and learned through an integrated approach. The second teacher, (Teacher B), supervised a class of 9 students and utilized an integrated approach utilizing the Model 50 Teaching Aid along with the usual classroom instruction.

Each teacher had in-service training in the use of the Model 50 and manner of presenting material using it. Each group participated in an orientation when there were discussions on advantages of knowing and recognizing various tools. The machine groups, in addition, practiced using the Model 50. No workbooks were used during the orientation period. Each group was pre-tested on the subject matter.

Analysis of variance using a randomized group design demonstrated no differences between groups on the factors of intelligence and reading level. The groups differed significantly on pre-test scores. The integrated method group had the highest pre-test error rate. The difference was statistically significant in comparison with both automated and conventional method groups. No statistically significant differences were found between automated and conventional method groups.

The study was limited by socioeconomic factors and class level. Students taught by teacher A were generally from "white-collar" backgrounds. The integrated method groups were 8th grade E.M.R. students, the conventional method groups were 9th grade E.M.R. students. The automated method group was a 9th grade E.M.R. class from typically "blue-collar" backgrounds.

The automated group met one hour for three consecutive days. Each day students practiced tool recognition using the Model 50 with two of the workbooks. Time needed to complete the task varied from student to student. With both integrated and conventional method groups, students met for 4 one-hour sessions. Tool displays supplemented lectures and discussions for both classes. At program conclusion, the pre-test was re-administered.

Results - A one-tailed test was calculated for each treatment group for pre to post test results. Analysis of the three calculations indicated that each group increased in performance at a statistically significant level. Greatest error reduction occurred in the group taught by the teacher machine combination. Table 1C summarizes the significance of differences between means for pre to post-test error score reduction.

Difference scores were calculated for each group and an analysis of variance using a randomized groups design was performed to determine if a statistically significant difference existed between groups in terms of pre to post-test gains. Groups were found to differ at the .01 level of confidence. Table 2C gives the analysis of variance results.

Two-tailed t tests were calculated to compare gain scores for each treatment combination. Tables 3C, 4C, and 5C summarize the significance of differences between means for difference score comparisons.

No statistically significant differences were found comparing automated and conventional approaches. Statistically significant differences were found comparing automated and integrated methods, and conventional and integrated methods. In both instances, greater gain was demonstrated by the integrated methods group.

Table 1C

Significance of Difference Between Means for Pre to Post Test Error Score Reduction

Group	Pretest Mean	Pretest SD	Post Test Mean	Post Test SD	t	P
Automated	8.85	3.50	5.5	3.47	1.82	.05
Integrated	13.00	2.82	6.44	3.31	4.28	.001
Conventional	8.77	3.09	6.61	3.19	1.71	.05

Table 2C

Analysis of Variance of Difference scores between Pre and Post-Tests for Automated Conventional, and Integrated Methods Groups 1 - 1

	S.S.	df	M.S.	F	P
Treatment	109.31	2	54.66	4.36	.01
Error	363.91	29	12.55		
Total	473.22	31			

Table 3C

t Test of the Difference Between Automated and Conventional Method Groups

Test	Automated Mean	Automated SD	Conventional Mean	Conventional SD	t	P
Tool Recognition	3.00	1.73	2.15	3.68	.64	NS

Table 4C

t Test of the Difference in Means Between Conventional and Integrated Method Groups

	Conventional		Integrated			
Test	Mean	SD	Mean	SD	t	P
Tool Recognition	2.15	3.68	6.56	4.19	2.48	.025

Table 5C

t Test of the Differences in Means Between Automated and Integrated Method Groups

	Automated		Integrated			
Test	Mean	SD	Mean	SD	t	P
Tool Recognition	3.00	3.47	6.56	4.19	2.32	.025

The results of this experiment suggest that: (1) mentally retarded special class students can learn to recognize various carpentry tools whether they are taught by conventional methods, automated methods or integrated methods; (2) when the teacher utilized the Model 50 Teaching Aid to reinforce concepts introduced, significantly greater performance gain resulted, than of the other method used; (3) savings in class time was evident for the automated group. Gain was identical to that of the conventional methods group, but not to that of the integrative methods group.

HOW TO USE THE TELEPHONE - Two studies are reported using the telephone series which was designed to develop skills in locating selected phone numbers and the following through by dialing these numbers.

Study Number One - The telephone series was field tested at The Devereux Schools, using 14 male and 14 female brain-damaged adolescent students. Subjects were pre-tested and then randomly assigned to each of two groups. Statistical comparisons demonstrated no difference between groups in age, I.Q., or pre-test scores.

Procedure - Two methods of instruction were employed with a different teacher used for each approach. Group #1 was presented material using a combined teacher-learning-aid approach. Group #2 was presented materials in a conventional manner. The same content was covered for both groups. Both groups met for one hour per day for five consecutive days. Upon completion of the program, students were tested.

Results - Results indicate that the group which utilized both the teacher and the programmed material, showed greater gains than the group which used only the teacher. A comparison of the differences of the means on the pre and post-tests between the two groups was significant at the .05 level of confidence in favor of the experimental group.

Since students are permitted to telephone home under the supervision of staff members, informal observation of the subjects in the study, by two of the unit supervisors, was employed to determine the effects of the two methods in a practical applied situation. Without information as to which students were in the experimental or control groups, the two unit supervisors were asked to indicate which students, of the 28 in the study, were able to handle the telephone with greater ease. Reviewing their observations, it was noted that in a practical situation, 70% of the integrated group, while only 30% of the conventional method group, were rated as much improved in using the telephone.

Study Number Two - A second evaluation of the telephone series was made at a public junior high school. Two classes of educable mentally retarded students participated. The students had participated in an earlier study involving the tool recognition program and had been instructed by the integrated and conventional methods. In this experiment mode of presentation was switched so that students previously taught conventionally were now taught using the teacher-machine combination and vice versa. The same teacher was used in this experiment who had taught in the tool recognition study.

Procedure - Prior to instruction, the integrated group was given a session on how to use the Model 50 Teaching Aid. Each group was administered a pre-test. No statistically significant differences were found between classes on mean error rate. Table 1D gives a description of pre-test results.

Table 1D

A comparison of Mean Error Scores on a Pre-test on Learning to Use the Telephone

Group	Integrated		Conventional			
	Mean	SD	Mean	SD	t	P
	14.92	2.79	14.64	3.04	.18	NS

One Teletrainer unit supplied by the Bell Telephone Company was used with both experimental methods. The Teletrainer is used for training students in the use of the telephone. It is composed of a central unit with switches that the teacher can use to cause two phone outlets, wired from this unit, to ring, demonstrate busy signals, dial tones, etcetera. Students may use the phone outlets in the same way they would a regular phone. Conversation, of course, can only be made between the two phones.

The Teletrainer unit, because of its observed play value, might be considered a novelty item. It is reasonable to assume that if there were a novelty effect for the group using the Model 50 Teaching Aid with the Teletrainer unit, it would be no greater than when the teacher uses the Teletrainer in a conventional approach.(Under both treatment conditions, this would serve to supplement and bring life centered materials into the classroom.)

The design called for both groups to meet for 8 consecutive one-hour sessions (excluding weekends.) Snow and adverse weather conditions caused the school to be closed for two days midway through the study. The following week, the school system was closed because of snow for an additional week. Because of administrative time factors, the program was completed with no time available for review of subject matter. Although these factors probably affected performance, it is not known if one group was affected more than the other.

Results - The experiment was completed after the students returned. Post-testing was done upon completion of the last class period.

Data were analyzed comparing both groups on mean post-test error scores. Table 2D describes the significance of difference between post-test means.

Table 2D

A Comparison of Mean Error Scores on a Post-test on Learning to Use the Telephone

Group	Integrated		Conventional			
	Mean	SD	Mean	SD	t	P
	11.83	3.61	13.1	4.27	.88	NS

No statistically significant differences were found between groups.

Groups were used on their own controls comparing pre- to post-test mean error scores.

Error reduction from pre- to post-tests was not significant for the conventional method group.

Error reduction from pre- to post tests was significant for the integrated method group at $p < .025$.

Tables 3D and 4D provide a comparison from pre- to post-test gain for intergrated and conventional method groups.

Table 3D

A Comparison of Mean Error Scores from Pre- to Post-tests for the Conventional Method Group

	Pre-test		Post-test			
Conventional Method	Mean	SD	Mean	SD	t	P
	14.64	3.04	13.1	4.27	.93	NS

Table 4D

A Comparison of Mean Error Scores From Pre- to Post-tests for the Integrated Method Groups

Integrated Method	Pre-Test		Post-Test			
	Mean	SD	Mean	SD	t	P
	14.92	2.79	11.83	3.61	2.17	.025

The results of the two experiments using the telephone series suggest that: (1) groups taught by the integrative methods demonstrated significant gain over groups taught by conventional methods; (2) in the case where students were observed using the telephone in a practical setting, qualitatively superior performance was demonstrated for the integrated method group students.

For this study, it is likely that treatment effects cannot be attributed solely to a novelty or "new game" effect where the Model 50 Teaching Aid was used. The introduction of an item which is likely more of a motivator because of its play value than is the Model 50, probably washed out any group differences attributable to this effect. "Hawthorn effect" was compensated for by attempting to give both groups equal attention, i.e., pre-testing and post-testing orientation period.

Home Nursing Program - An intensive study was undertaken to investigate the effectiveness of three methods of programmed instruction in presenting a Home Nurse's training course for mentally retarded adolescent girls. The study was conducted at Laurelton State School, in Laurelton, Pennsylvania. This is a residential school serving 900 individuals who reside in cottage units. The institution population consists of court committed, puberty through menopause females from lower socioeconomic backgrounds who are moderate to borderline retardates. In this respect, it is quite unique. Subjects used for this study were a population of fifty-four non-psychotic mentally retarded adolescent females between ages 16 and 19. Non-psychotic diagnosis was based upon a battery of psychological tests, including at minimum the Wechsler Adult Intelligence Scale (WAIS), Rorschach, Bender Gestalt, and Draw-a-Person test, which were part of each individual's intake evaluation.

Procedures

Evaluation Instruments Developed for Study - A sixty-two multiple-choice test was prepared to measure student course achievement (Home Nursing Achievement Test). The test was developed in conjunction with content specialists and Psychological Consultants in Mental Retardation. The sequence followed in construction was that recommended by Trump and Haggerty (1952.) The instrument went through several item analyses and revisions prior to its administration to the experimental population. Odd even reliability was computed using product moment correlation and the Spearman Brown formula. An added reliability check was made using the deviation formula.

$$r=2\ (1-\frac{\sigma 1^2+\sigma 2^2}{\sigma t^2})$$

The deviation formula was used for the reason that the assumption of the Spearman Brown formula, the variables of the two half scores are equal, may not always be met (Anastasis 1961, pg. 122.) Reliability by each method was found to be .72. Standardization population were the fifty-four subjects in this study plus thirty-two comparable but older females (18 to 20 years of age) at the same institution.

A post-hoc reliability check was made to determine test re-test reliability. This was accomplished by correlating the results of the test administered at the conclusion of the course and two weeks after the termination of the course when it was used as a measure of retention. Reliability was determined to be .89 using the product moment correlation (N=52.)

A check list was developed to help determine proficiency on a performance test. Content covered was a sample of the areas taught each treatment group. It was designed so that the student could receive two possible scores, +1 if she made a correct response, 0 if her response was not correct. Additional space was provided for the recorder to list other responses not inherent in this program, but which could be correct.

A student evaluation form was developed that focused upon student appraisal of the course. This consisted of seven questions requiring students to select one of the three possible preferences.

The fourth instrument was constructed to tap student liking vs. disliking of the Model 50 Teaching Aid, the class in Home Nursing, and the classroom teacher (Programmed Instruction Attitude Scale.)

Experimental Design - The focus of the programmed course in Home Nursing is upon providing the occasion for the retardate to develop theoretical knowledge in the care of the sick and injured. The program itself was designed to be used in classes for training mildly retarded adolescent girls for employment as home nurses in institutional settings. It was developed to be used in conjunction with classroom demonstrations and student practicum experiences.

The Home Nursing programmed workbook series was developed specifically for use with the adolescent borderline retardate. It is based upon the American Red Cross Home Nursing Course. It was developed in collaboration with a content specialist and programming expert. The subject matter consists of such topics as: hand washing, bed making, bed baths, using the cover-all apron, feeding the patient, washing rubber gloves, making the patient comfortable in bed, helping the patient out of bed, the back rub, and mouth care. The total number of program frames is 912.

The experimental design provided for six sub-groups, a proficiency test control group, two nursing instructors, and three methods of presenting programmed materials.

Fifty-four mentally retarded adolescent girls between the ages of 16 and 19 were pretested using the home nursing achievement test and then randomly assigned to one of the six sub-groups. An additional group of comparable, but older females (18-20 years of age) were tested at the same time. The purpose of this additional group was to add information as to the reliability of the test; secondly, 17 of these girls served as subjects in a control group which was compared with the six treatment groups on a proficiency test.

Participating instructors were two nurses who, in addition to a R.N. possessed a B.S. degree, which qualified them to instruct nursing trainees. Both were certified by the Red Cross to teach Home Nursing. Both had ten years or more of experience working with and teaching mentally retarded adolescent girls at Laurelton State School. Both had taught the course previously, but not to any of the students in this study. Each teacher was assigned three groups of nine students each.

Analysis of variances were computed to determine the comparability of the treatment groups on the variables of Wechsler Full Scale I.Q., Wide Range Achievement Test - reading level, age, length of time institutionalized at Laurelton, and home nursing pre-test achievement scores. No statistically significant differences were found between groups on any of the variables. Table 1E gives a description of the experimental population. The column labeled F gives the interger to be compared to a significant F ratio of 2.38 a+ $p \angle .05$. The range, standard deviation and group means describe the experimental population (n=54).

Table 1E

F ratio and description of the experimental population on the variables of intelligence, reading level, length of time institutionalized, age and pre-test scores.

Variable	Range	Standard Deviation	Mean	F
Intelligence (WAIS Full Scale I.Q.)	51-91	8.82	68.33	.83
Reading Level	3.9-7.0	.81	4.81	.53
Length of time institutionalized (years)	.66-4.30	1.10	2.32	.40
Age	16-19	.82	17.73	.25
Pre-test error scores(Maximum 62 errors)	26-51	5.74	36.22	.40

These groups received instruction in subject matter related to care of the sick and injured, taught by automated methods, integrative methods, and programmed lecture methods. In-service training was provided for both nursing instructors. An orientation period for students participating in the program evaluation was conducted prior to beginning the instructional phase of the experiment. They were informed at this time the Red Cross would provide certificates for those successfully completing the program.

Teachers were provided with a twenty-two page booklet covering material in the same sequence as the programmed workbook. This provided the lecture material and format for the programmed lecture and integrated method groups.

Lectures for both instructors were tape-recorded. This acted as a check to assure all groups were being exposed to the same material at approximately the same rate. It also served to function as an additional novelty item in the classroom situation. It is possible that introduction of the tape-recorder into the classroom taught by program lecture methods might have a new treatment effect on that group and as such could equate for possible novelty effect for groups using the Model 50 Teaching Aid.

Results - At the conclusion of the classroom phase of the study, students were administered the Home Nursing achievement test, and filled out the student evaluation form and programmed instruction attitude scale.

Five days later, students took a proficiency test covering the didactic materials disseminated, and demonstrated, during the course. The proficiency test was held at the institution hospital. Five stations were set up to test student's practical skills and knowledge in care of the sick and injured. Students other than those participating in the experiment role played as patient. Each station was designed so that it was "life centered." Materials used were authentic.

Five registered nurses at the institution were used as raters. This group of personnel were trained on the procedure to be followed which included several supervisory pre-trials, and practice runs with students other than those participating in the experiment. This assured a standardized mode of evaluation.

The procedure for this testing was as follows:

a. Students were randomly assigned times to be at the hospital for test purposes.

b. Each student that participated in the classroom phase along with seventeen older, but comparable students who originally took the Home Nursing achievement test were given a proficiency test check list which they presented at each of the performance test stations.

c. The student would attempt the designated tasks at each station, then move on to the next until she had worked at all five sections. Students worked at each station from five to ten minutes. Except, perhaps, in the case of a few students, raters had no prior knowledge as to which person was taught by what method, or if they had gone through the classroom phase.

d. Nurses wrote down responses made by each student which were not provided for on the check list.

Two weeks after the classroom phase, the students were administered the achievement test, which served as a measure of retention.

This study involved a comparison of three different methods of presenting material on home nursing by two different teachers, each instructing three equivalent groups. An additional group was introduced which had not gone through the classroom phase of the study. This group served as a control for the proficiency test. The dependent variables analyzed were gain scores between pre and post-test, retention, as measured by the re-tests, time to complete the tests, proficiency in a practical situation, attitude toward teacher and machine, and evaluation of groups, methods, and teacher.

During the course of the investigation, two students were forced to drop out. One girl was hospitalized because of illness, the other was released from the institution so that she might go to work. Both belonged to different groups. Absenteeism was equally distributed throughout the groups. No one person missed more than two sessions.

t tests from pre to post-test were calculated for each treatment group. Differences were highly reliable statistically. All groups had gained at better than the $p < .01$ level of confidence.

Table 2E is a description of the significance of differences between means from pre to post-testing. For ease of identification, one teacher will be designated as A, the second teacher will be designated as B.

Table 2E

Significance of differences between means from pre to post-tests for each of the treatment conditions.

		Pre-Test		Post-Test			
	Teacher	Mean	SD	Mean	SD	t	P
Automated	A	37.89	5.19	19.00	4.83	7.59	.001
Integrated	A	35.33	6.32	20.50	5.17	4.80	.001
Programmed lecture	A	34.67	4.00	23.00	3.89	5.94	.001
Automated	B	36.44	6.15	15.00	8.79	4.82	.001
Integrated	B	37.22	5.37	21.00	3.77	6.63	.001
Programmed lecture	B	35.56	4.74	26.76	7.38	2.94	.01

Originally, a 2 x 3 factorial design was designated to determine if differences existed between treatment groups because of methods or teachers, and to test whether these two factors interacted. Prior to this calculation, a product moment correlation was computed between pre-test scores and gain scores. The purpose of this correlation was to answer questions as to whether any significant relationship existed between student pre-test score level and amount of performance gain. The resulting correlation coefficient, $r= -.19$, was not statistically significant. No significant relationship, therefore, was found to exist between pre-test scores and gain scores. Necessity of using a multi-variate analysis of covariance design was ruled out, and a 2 x 3 analysis of variance was computed. Table 3E gives the results of the analysis.

A statistically significant difference was found to exist between the three methods. No differences were found between teachers. There was no interaction between teacher and method. At least one group, therefore, differed from the other as a result of the experimental treatments. Multiple comparison of the treatment conditions were made using Scheffé's test. Alpha was set at .10[1].

Results of comparisons of treatment conditions demonstrated greater mean differences when both the automated and programmed lecture method groups taught by Teacher B were tested for significance. The automated method group taught by Teacher A was compared to B's programmed lecture group. The automated group demonstrated greater gains at $p < 01$ level of confidence. Automated method group B demonstrated significantly greater gain over programmed instructional group A at $p < .01$. When the average gain score of the two groups for each treatment condition was calculated; the automated method demonstrated significantly greater gain ($p < .001$) in comparison to the programmed lecture group; the integrated method group gained over the programmed lecture group at $p < .06$; no statistically significant differences were found between the automated and integrated method groups. Least statistically significant differences were found between like comparisons i.e., integrated method group A and integrated method group B. Table 4E summarizes the results of Schaffe's test.

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[1] Larger differences are required for significance in using Scheffe's test. Scheffe's suggests that with this test one might consider taking α .10 rather than α .05.

Table 3E

Analysis of variance of differences between gain scores for treatment conditions and teachers.

Source of Variation	Sames of Squares	Degree of Freedom	Mean Squares	F	P
Methods	729.04	2	364.52	16.29	.001
Teachers	5.56	1	5.56	.25	N.S.
Interaction	36.51	2	18.26	.81	N.S.
Error	1051.87	47	22.38		
Residual	1088.38	49	22.21		
Total	1822.98	51			

N=52

t tests were computed to determine significance of differences between means from post to re-test conditions. Each group was used as its own control. No statistically significant gains or losses were found for any of the treatment conditions. Table 5E provides a description of the groups on post-test and re-test comparisons.

A simple analysis of variance using a randomized groups design (Edward 1961) was calculated to determine if significant differences existed between treatment and control conditions on the proficiency test. (see Table 6E).

Table 4E

Summary of Comparison Between Groups in Gain Score Using Schaffe's Test

Teacher		A			B	
Group	1 Programmed	2 Automated	3 Integrated	4 Programmed	5 Automated	6 Integrated
Mean Gain Score	12.05	18.89	15.50	8/87	19.63	15.47

Comparison	t	P
1 vs 2	3.08	N.S.
1 vs 3	1.52	N.S.
1 vs 4	1.43	N.S.
1 vs 5	3.34	.10
1 vs 6	1.54	N.S.
2 vs 3	1.49	N.S.
2 vs 4	4.51	.01
2 vs 5	.33	N.S.
2 vs 6	1.54	N.S.
3 vs 4	2.92	N.S.
3 vs 5	1.74	N.S.
3 vs 6	.01	N.S.
4 vs 5	4.74	.01
4 vs 6	2.97	N.S.
1 and 4 vs 2 and 5	5.52	.001
1 and 4 vs 3 and 6	3.47	.06
2 and 5 vs 3 and 6	2.05	N.S.

Table 5E

Significance of differences between means from post to re-tests for each of the treatment conditions.

		Post-test		Re-test			
Group	Teacher	Mean	SD	Mean	SD	t	P
Automated	A	19.00	4.83	19.22	7.63	.07	N.S.
Integrated	A	20.50	5.17	18.75	5.76	.60	N.S.
Programmed lecture	A	23.00	3.84	20.44	4.85	1.17	N.S.
Automated	B	15.00	8.79	16.62	9.69	.33	N.S.
Integrated	B	21.00	3.77	19.44	3.43	.86	N.S.
Programmed lecture	B	26.77	7.38	25.67	7.28	.03	N.S.

n=52

Table 6E

Analysis of Variance for Proficiency Test Scores Between Treatment and Control Groups

SV	SS	df	MS	F	P
Between	2479.00	6	413.17	10.14	.001
Within	2524.25	62	40.71		
Total	5003.25	68			

Results were highly significant ($p<.001$). To determine if significant differences existed between means for the treatment conditions and the control condition, Dunnett's test for comparisons with a control was calculated. In all comparisons, significantly greater performance was demonstrated by treatment groups at $p<.01$. Most highly significant, were performance scores obtained by both integrated method groups, and the programmed lecture group taught by Teacher A. Table 7E gives the results of Dunnett's test.

Table 7E

Significance of Differences Comparing Each Treatment Condition With the Control Condition or Proficiency Test Performance.

Teacher		A	A	A	B	B	B
Group	Control	Programmed Lecture	Automated	Integrated	Programmed Lecture	Automated	Integrated
Means Proficiency test scores	34.76	50.67	43.22	50.87	45.00	44.44	49.11
Mean Difference		15.91	8.46	11.11	10.24	9.98	14.35
P		.001	.01	.001	.01	.01	.001

n=69

A review of extra response categories on the proficiency test check list revealed that a greater percentage of responses which could be correct, but were not listed as such were made by members of the experimental group as compared to the control group. Differences were not statistically significant.

A 2 x 3 analysis of variance design was used to determine if differences existed between treatment groups on proficiency test performance because of methods or teachers, and to test whether these two factors interacted. Results indicate that at least one group differed as a result of treatment conditions. Significance was at $p < .01$. No differences were found between teachers. The two factors did not interact. Table 8E describes the analysis of variance results.

Table 8E

Analysis of Variance for Proficiency Test Scores for Treatment Groups.

Source of Variation	SS	df	MS	F	P
Treatments	322.03	2	161.02	4.77	.01
Teachers	44.33	1	44.33	1.31	N.S.
Interaction	121.67	2	60.84	1.80	N.S.
Error	1555.20	46	33.74		
Residual	1676.87	48	34.99		
Total	2043.23	51			

n=52

t tests were calculated to determine significance of differences between means for groups taught by Teachers A and B. To reduce overlapping information, groups were not compared with every other group, only with those in their own section. Tables 9E and 10E give a description of significance of differences between means.

Table 9E

Significance of Differences Between Means for Groups Taught by Teacher A

Comparison	Integrated vs. Automated	Programmed Lecture vs. Automated	Programmed Lecture vs. Integrated
t	2.68	2.45	.09
p	.01	.05	N.S.

Table 10E

Significance of Differences Between Means for Groups Taught by Teacher B

Comparison	Integrated vs. Automated	Programmed Lecture vs. Automated	Programmed Lecture vs. Integrated
t	1.66	.13	1.66
p	N.S.	N.S.	N.S.

For groups taught by Teacher A, the integrated method group demonstrated significantly stronger performance on the proficiency test than did the automated methods group ($p < .01$). The programmed lecture group demonstrated greater proficiency than the automated method group at $p < .05$. No differences were found between programmed lecture and integrated method groups. For groups taught by Teacher B, no statistically significant differences were found between treatment conditions. However, a trend was in favor of stronger proficiency test performance for the integrated method group.

t tests were computed for the variable time to complete the achievement test for pre to post-test conditions. Each group was used as its own control. Time reduction appeared to occur most significantly in those treatment conditions where the Model 50 Teaching Aid was used. Automated method groups demonstrated greatest savings in time to complete the post-test. No statistically significant time savings was found for the programmed lecture groups taught by Teacher B. Table 11E provides a description of pre to post-test time savings.

Table 11E

Significance of differences between means for treatment conditions

		Pre-test		Post-test			
	Teacher	Mean	SD	Mean	SD	t	P
Programmed	B	28.44	5.91	21.33	7.05	1.17	N.S.
Automated	B	26.33	5.57	15.89	1.90	5.05	.001
Integrated	B	26.13	6.73	14.50	6.04	3.41	.01
Programmed	A	23.22	5.66	19.44	3.49	3.03	.01
Automated	A	32.63	6.03	16.50	3.08	6.30	.001
Integrated	A	23.44	6.25	15.00	4.58	3.43	.01

Analysis of covariance was computed to determine if differences existed between treatment conditions on time to complete the pre and post-tests. Results were significant at p∠.05. Table 12E summarizes covariance results.

Table 12E

Analysis of covariance for time scores between pre and post-tests

Source of Variation	SS	df	MS	F	P
Treatments	-153.94	5	-30.78	-3.196	.05
Error	433.43	45	9.63		
Total	279.49	50			

n=52

Means were adjusted and t tests performed to determine significance of differences between adjusted mean scores. To reduce overlapping information, groups were not compared with every other group, only with those in their own section. Tables 13E and 14E give a description of significance of differences between means. A two tailed t test was used.

Table 13E

Significance of differences between adjusted time score means for groups taught by Teacher A.

Comparison	Integrated vs. Automated	Programmed Lecture vs. Automated	Programmed Lecture vs. Integrated
t	1.33	2.55	1.54
p	N.S.	.025	N.S.

n=27

Table 14E

Significance of Difference Bewteen Adjusted Time Score Means for Groups Taught by Teacher B.

Comparison	Integrated vs. Automated	Programmed Lecture vs. Automated	Programmed Lecture vs. Integrated
t	.56	3.18	2.29
p	N.S.	.01	.05

n=27

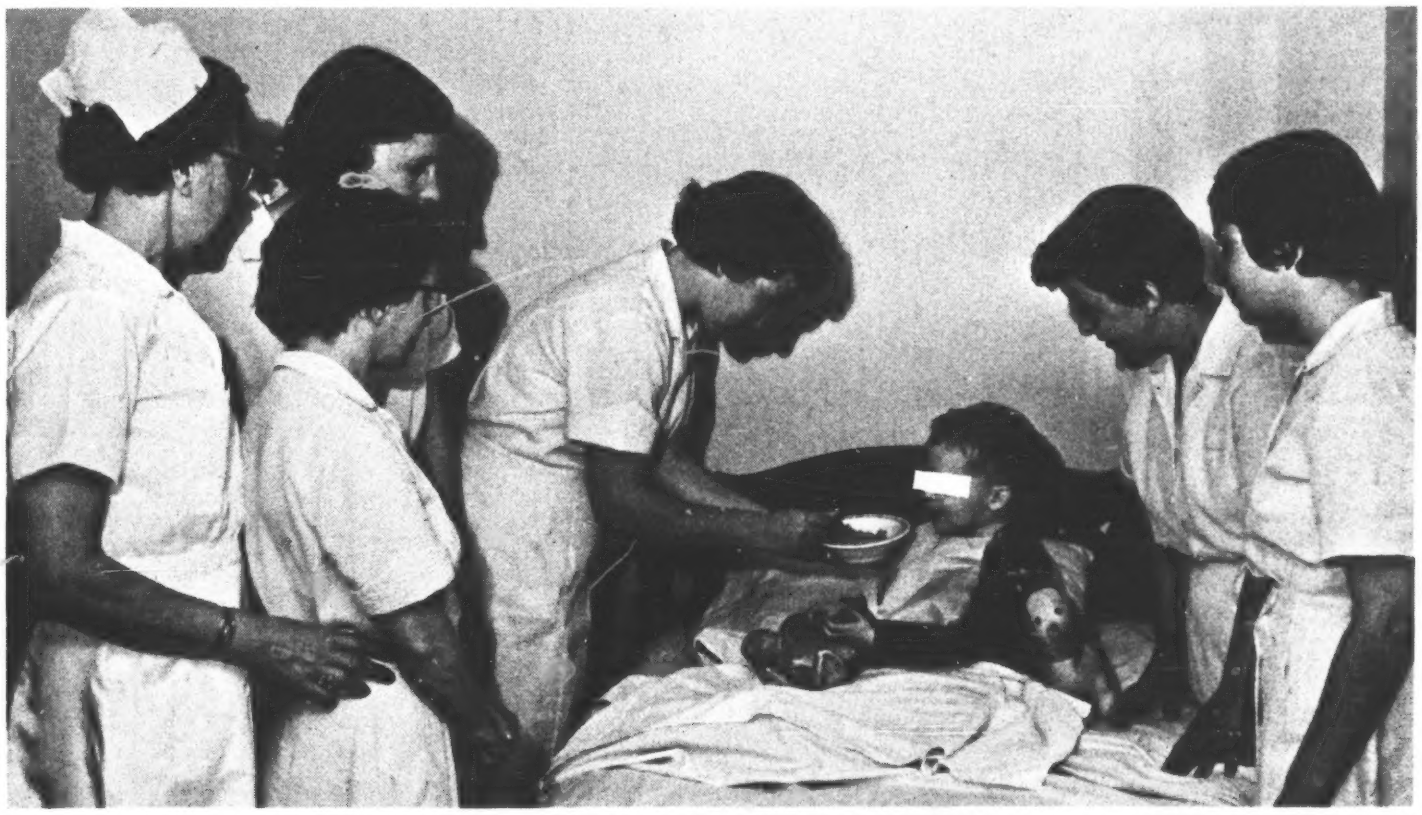
For groups taught by Teacher A, the automated method group was able to complete the post test more rapidly than the programmed lecture group ($p < .025$). Neither of the other two comparisons yielded statistically significant results.

For groups taught by Teacher B, the automated method group was able to complete the post test more rapidly than the programmed lecture group ($p < .01$). The integrative method group was able to complete the post test more rapidly than the programmed lecture group ($p < .05$). No significant difference was found between automated and integrative method groups.

On a Student Perception Form, each treatment classification evaluated themselves in terms of what they believed their performance to be in comparison to persons in their own groups and those in other groups. Appendix C is a reproduction of this form. With little exception the majority of students, across treatment conditions, saw themselves as doing no better and no worse than others. The majority of students preferred to remain in the same class they had been in, and expressed a liking for content material on home nursing. A sizable minority, however, in the automated methods group (35%) expressed a preference to be in another class. The groups appeared to differ as to whether they would prefer being taught by a teacher, a teaching machine, or both teacher and machine. Only one student out of the 52 preferred to be taught by the machine only. Most students in the programmed instruction groups preferred being taught by teacher (61%) or by both a teacher and a machine (39%). Most students in the automated group expressed a preference to be taught by both machine and teacher (53%) and a nearly comparable minority (41%) expressed a preference to be taught by teacher alone. The groups which had been taught by both teacher and machine clearly preferred this combination (76%) over the other two approaches. Twenty-four percent of this group, however, still preferred to be taught by teacher alone.

The results of analyzing attitude toward the Model 50 Teaching Aid and the instructor suggests students on the whole, preferred working with the teacher in preference to the machine. (Appendix D is a reproduction of this form.) Students who used the teaching aid were more favorably disposed towards it than were students taught by the teacher alone. However, the majority of students in each class preferred working with the teacher if a choice were given them. Each group felt they profited from the experience and learned from it. The students taught using the Model 50 Teaching Aid overwhelmingly believed their class was taught in a way different from that which they had been taught before (97%). Students taught by programmed lecture methods, believed they, too, were taught in a new way (83%).

Programmed instruction was a reliably good method of presenting information to a population of mentally retarded adolescent females at Laurelton State School. From the standpoint of greater measured acquisition using an achievement test, the automated method is most efficient from the standpoint of both time and level of achievement. The integrated group proved to be more efficient in the area of transfer to a work situation in comparison to both automated method groups and one programmed lecture group. This factor combined with higher mean score on the achievement test as compared to programmed lecture methods, recommends the integrated method group as the better all around method of presentation.



Students in Home Nursing Practicum

RESEARCH HIGHLIGHTS

Part C

SUMMARY - Sections IX and X of the Chapter on Research Highlights discusses: (1) preliminary field testing using the programmed instructional material developed for use with most of the auto-instructional teaching aids reported in Sections III through VIII; and (2) more current field testing of programmed instructional material developed for use with the Model 50 Teaching Aid. The studies reported in these two sections were designed to evaluate the effectiveness of utilizing the prepared programmed instructional material in vocational training of mentally retarded and/or emotionally disturbed adolescents. The following four different teaching methods were employed:

1. Automated method - a procedure where teacher function is to guide students in the use of the auto-instructional device and to supervise and encourage continued activity utilizing the teaching aid. The teacher maintains a record of student progress and sees that he is operating the machine properly. No formal classroom lesson is taught. The course content is made up of prepared programmed instructional material.

2. Conventional method - a technique where teacher function is to present material using proven approaches such as lecture, discussion, demonstration, etc. The teacher is responsible for planning the lesson. No use is made of auto-instructional devices.

3. Integrated method - a technique wherein the teacher employs auto-instructional devices with programmed instructional material in addition to utilizing proven teaching approaches.

4. Programmed lecture approach - a method which deviates from conventional procedures through utilization of lecture materials prepared and used by the teacher that follows the same sequential steps and content outlined in the programmed vocational instructional units.

Basic experimental design, for the most part, included a comparison of the effect of utilizing the four described teaching techniques in presenting vocational training material to the mentally retarded or emotionally disturbed adolescents comprising the population of this study. In most cases equated groups of students from Devereux Schools and from other residential settings and public school special classes were utilized in the studies. Occasionally, this was neither possible or desirable. When equated groups were not employed, studies dealt with "life-centered" situations and the methods were evaluated using classes for educable mentally retarded students. It was not the intent of the investigators to pit the teacher against the machine; rather, more effective ways were sought which might help special class teachers to develop a learning atmosphere utilizing automated instructional materials.

Several preliminary field tests were conducted which involved the development of skills in work related areas such as filling out job application forms and in applying for a job. Two of these studies used material prepared for use on the Model 50 Teaching Aid; two others utilized the Mast Teaching Machine and another study used a program on "Applying for a Job" which was prepared for use on the Graflex Audio-Graphic Instructor. A study involving measurement in the kitchen utilized the A-V-K technique. Later field testing concentrated on the use of the Model 50 Teaching Machine and employed programmed instructional units encompassing: job responsibilities, tool recognition, how to use the telephone and instruction in home nursing.

Statistical treatment of the obtained data included simple and complex analysis of variance designs, analysis of covariance, Dunnett's test with a control, Shaffe's test for multiple comparisons, and one and two tailed "t" tests. The statistical procedures were employed to determine if differences existed in the acquisition of instructional material between the four teaching approaches, as measured by achievement and/or performance tests. The findings obtained in these studies and their implication are discussed in detail in the two preceding sections.

In general, employment of programmed teaching units in vocational training of the population utilized in the project, resulted in greater retention of the instructional material as measured by the pre and post tests, than was the case in classroom instruction along conventional lines, without the benefit of the teaching aids. However, perha of greater significance, from the standpoint of the population served, was the fact that the experimental group, which had the added benefit of instruction utilizing automated teaching devices, showed greater ease and a higher degree of proficiency in handling simulated job situations, as encountered in role playing during group guidance programs, as well as in practicum and applied work situations.

CONCLUSIONS AND IMPLICATIONS - In an analysis of the data obtained in the studies evaluating the effectiveness of utilizing programmed instructional materials in vocational training of mentally retarded and emotionally handicapped adolescents, which are report in detail in Sections IX and X, six major findings emerged:

1. The "automated" teaching method which used prepared programmed instructional materials was, in most cases, more efficient than the conventional and the programmed lecture method, when gains were measured by achievement test scores.

2. Of the four experimental teaching methods used, the integrated method, which used auto-instructional aids to reinforce and help stabilize concepts introduced by the teacher in the classroom, proved to be more effective in enabling students to transfer and to utilize learned material in a practical work situation.

3. Students who were taught by the machine method alone, demonstrated the weakest performance on proficiency tests.

4. When auto-instructional aids were introduced into the learning situation, there was a reduction in the time required by the students to learn the material presented. When class time was held constant, the groups using auto-instructiona aids were able to successfully complete the programmed lesson units in less time than was required by groups not utilizing auto-instructional aids.

5. When programmed instructional material was used in the learning situation, students demonstrated a better ability to remember what they had learned, as measured by retention tests.

6. Taken as a group, students using auto-instructional aids demonstrated a higher achievement and performance level on the criterion instruments than did those students for whom auto-instructional aids were not used. A close inspection of the attained individual scores, however, reveals considerable variations within each group, despite the teaching method employed.

It is suggested from the research findings reported in Sections IX and X, that the use of auto-instructional aids, however good the prepared programmed material may be, is not a panacea for learning by the mentally retarded and/or emotionally disturbed adolescent and is not intended to replace the classroom teacher whose personal enthusiasm and interest in the students is so important. However, studies have demonstrated that auto-instructional aids when properly integrated and used to enrich vocational training programs taught by qualified special education teachers:

a. help to stabilize concepts introduced by the teacher and provides for reinforcement of learning

b. provide a point of departure for discussion

c. allows the teacher to provide more individual attention to students who need such support

d. result in greater interest and self-pacing on the part of the students which may be helpful in working with the slow or the "reluctant" learner.

e. generally helps to enhance the performance level of the intellectually disadvantaged youth

Auto-instructional devices, using prepared programmed vocational material, have shown, in the studies encompassed in this project, to hold promise in vocational training programs for mentally retarded and/or emotionally disturbed adolescents and are worthy of further exploration. The development of instructional material focusing upon work related activities would seem to serve a real need for these disability groups and should prove to be a useful adjunct to vocational training programs which focus on more specific occupational areas.

SHARING INFORMATION
DEMONSTRATIONS AT PROFESSIONAL CONFERENCES

Many professional organizations have expressed interest in the Automated Teaching Aids project; members of the project staff were invited to present highlights of the program at several professional meetings.

August 1963 Annual Convention of the American Psychological Ass'n. Philadelphia, Pa.	Participation in Symposium on "Audio-visual Instructional Aids for Vocational Training of the Mentally Retarded;" Report of Progress; demonstration samples of programmed instructional units.
December 1963 Annual Conference of the Ass'n. of Rehab. Centers Chicago, Ill.	Presented paper on use of automated instructional materials in vocational rehabilitation training; led discussion group interested in use of the teaching aids under development

April 1964 Annual Convention of the American Personnel and Guidance Ass'n. San Francisco, California	Exhibit of newly developed automated instructional units on "world-of-work" series; demonstration of subject matter areas under consideration.
May 1964 Annual Convention of the American Psychiatric Ass'n. Los Angeles, California	Scientific exhibit; highlights of preliminary field testing; display of lesson units; demonstration of four techniques employed in developing programmed instructional units.
November 1964 Annual Convention of the National Rehabilitation Ass'n. Philadelphia, Pennsylvania	Demonstration of programmed instruction in vocational training of the mentally and emotionally handicapped; outline of plans for field testing.
February 1965 Invitational Conference Human Resources & Abilities, Inc. Albertson, New York	Participation in conference on "Rehabilitation and Training of the Mentally Retarded;" discussion of audio-visual aids used in an industrial setting for vocational training of the mentally retarded.
June 1965 Annual Convention of the American Ass'n. on Mental Deficiency Miami Beach, Florida	Participation in Symposium on "Research Aspects on Rehabilitation of the Retarded." Presented paper giving highlights of results obtained in initial field testing of programmed instructional aids.
May 1966 Annual Convention of the American Ass'n. on Mental Deficiency Chicago, Illinois	Final report and formal presentation of the highlights of the completed project in a symposium on "Audio-Visual Aids in Vocational Training of the Mentally Retarded;" Research findings obtained in developmental studies and in field testing; Display of publications and sample programmed instructional workbooks and auto-instructional materials developed in the project. Demonstrations of teaching devices employed in the project.

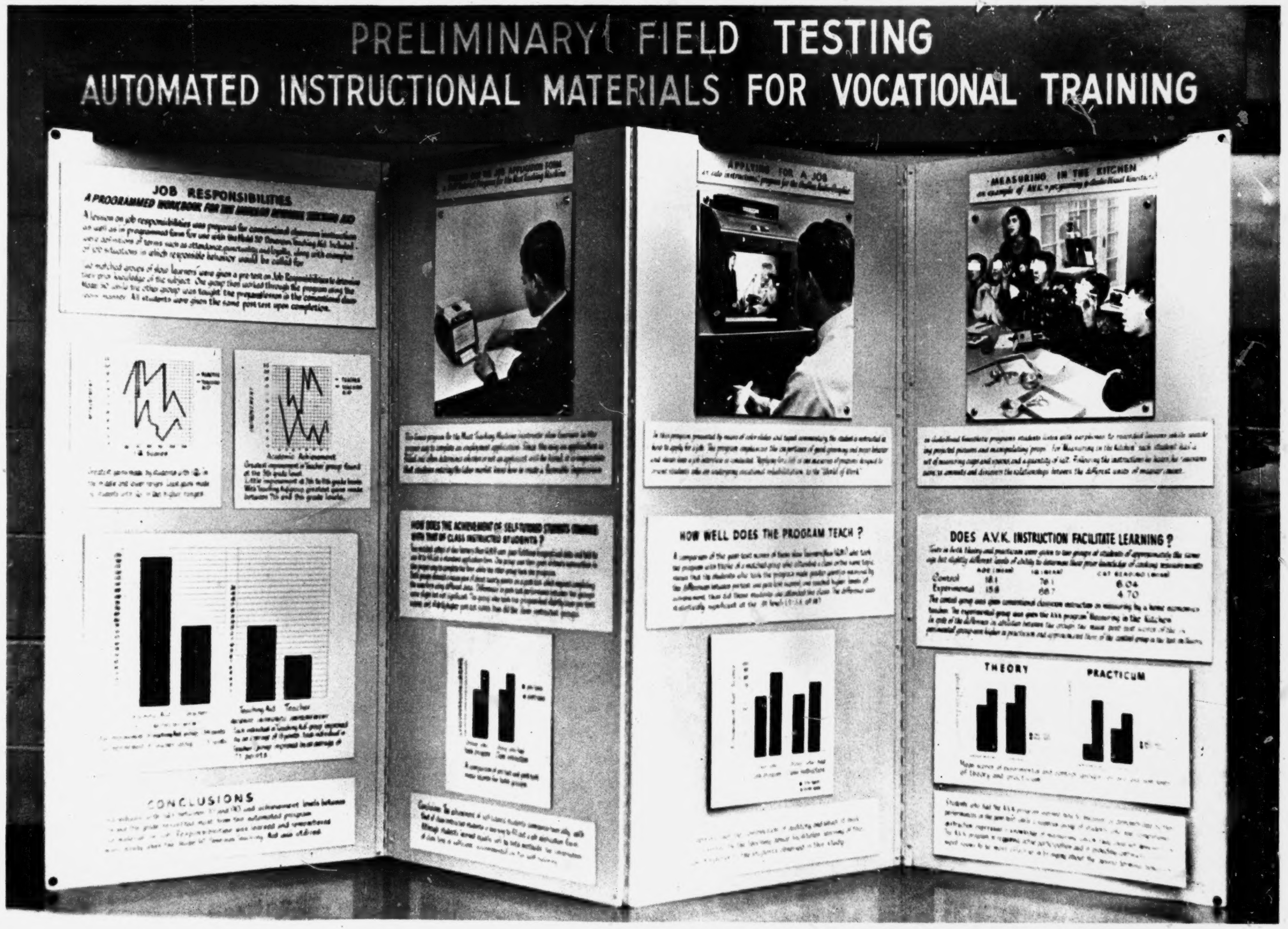
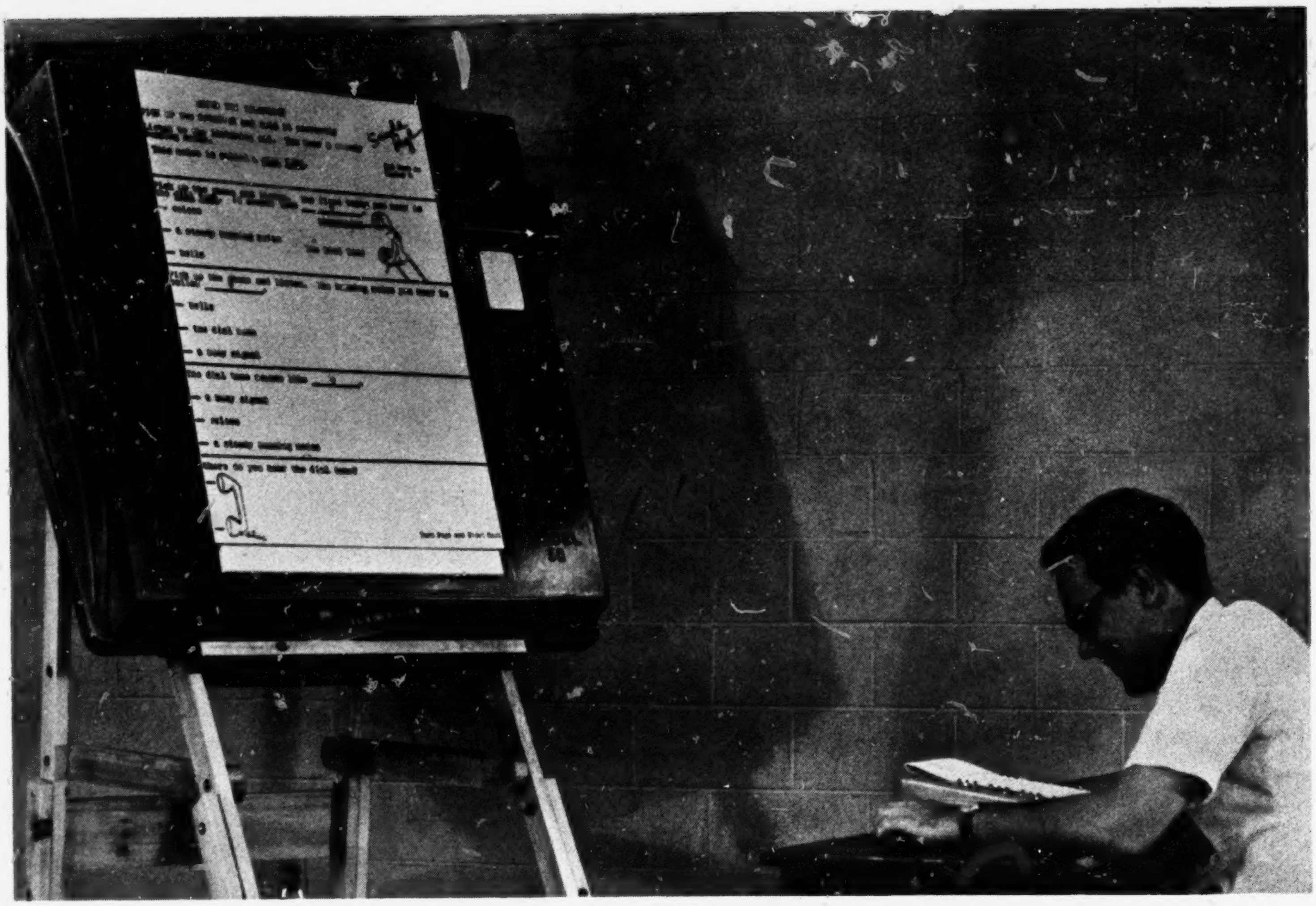

PRELIMINARY FIELD TESTING
AUTOMATED INSTRUCTIONAL MATERIALS FOR VOCATIONAL TRAINING
JOB RESPONSIBILITIES
A PROGRAMMED WORKBOOK
CONCLUSIONS
APPLYING FOR A JOB
HOW WELL DOES THE PROGRAM TEACH ?
MEASURING IN THE KITCHEN
DOES A.V.K. INSTRUCTION FACILITATE LEARNING ?
Control
Experimental
THEORY
PRACTICUM

Exhibit at Annual Convention of the American Psychiatric Ass'n., Los Angeles, California



Demonstrating the Use of the Model 50 Teaching Aid Utilizing a Large Scale Mock-up of the Device.

During the three years of the project several lecture-demonstrations covering highlights of the program were given at The Devereux Schools to special professional groups engaged in or planning to work in vocational rehabilitation of the mentally retarded or in related areas; i.e., rehabilitation research. These have included:

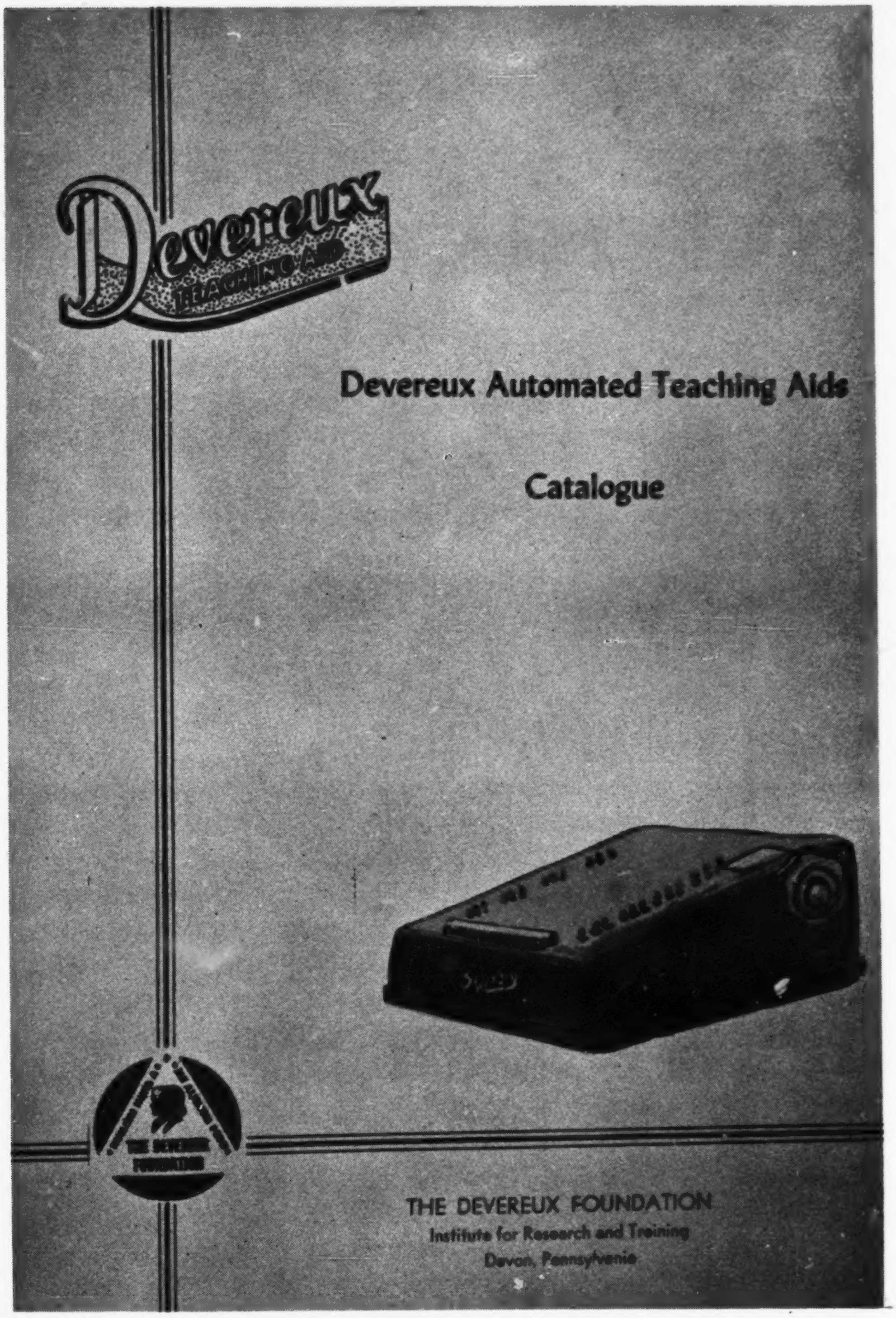
June 1963 repeated July 1963 Teachers College, Columbia University; at Devereux Schools, Mapleton-Hedges Campus, Willistown, Pa.	Work-Conference jointly conducted by Teachers College and Devereux Schools on "Vocational Rehabilitation of the Mentally and Emotionally Handicapped in a Residential Treatment Center."
March 1964 Devereux Schools, Manor Unit Campus, Berwyn, Pa.	"Career Day" for advanced undergraduate college students; opportunities for creative work with the mentally retarded and emotionally disabled.

May 1964 Univ. of Buffalo Rehab. Counselor Training Program Trainees; at Devereux Schools Campus, Glen Moore, Pa.	Special 2-day seminar-tour by faculty and students from Rehab. Counselor Training Program; Education and vocational rehabilitation of the mentally retarded.
April 1965 Devereux Schools Knollwood Campus Devon, Pa.	"Career Day" for students from leading Eastern colleges; program outlined career opportunities for work with the mentally and emotionally handicapped.
June 1965, repeated July 1965 Teachers College, Columbia University; at Devereux Schools, Berwyn, Pa. campus.	Work-Conference jointly conducted by Teachers College and Devereux Schools on "Counseling Mentally Retarded Students."
July 1965 Teachers College, Columbia University; at Devereux Schools' Summer Camps, North Anson, Maine.	Summer Institute conducted jointly by Teachers College and Devereux Schools on "Counseling the Mentally Retarded Student."

This project is supported in part by a research grant from the Vocational Rehabilitation Administration U.S. Dept. of Health, Education & Welfare.

Trying Out Graflex Instructional Programs

SUMMARY LIST OF PUBLICATIONS
AND
PROGRAMMED INSTRUCTIONAL MATERIALS
DEVELOPED IN THE AUTOMATED TEACHING AIDS PROJECT



Devereux
TEACHING AID

Devereux Automated Teaching Aids

Catalogue

THE DEVEREUX FOUNDATION

THE DEVEREUX FOUNDATION
Institute for Research and Training
Devon, Pennsylvania

INFORMATION BOOKLET - Automation in Vocational Training of Mentally Retarded and/or Emotionally Disabled Adolescents - a description of the Automated Teaching Aids Project supported, in part, by research grant 993-P-63 from the Vocational Rehabilitation Administration, U.S. Department of Health, Education and Welfare.

Sect. XIII

CATALOGUES - Two catalogues listing the instructional aids prepared in the project:

CATALOGUE OF AUTOMATED TEACHING AIDS - The complete listing of teaching aid devices, information bulletins, instruction manuals, and programmed instructional aids prepared and utilized in the VRA supported Automated Teaching Aids Project.

CATALOGUE OF MODEL 50 PROGRAMMED WORKBOOKS - An excerpt from the Catalogue of Automated Teaching Aids, listing only the series of programmed workbooks on various topics prepared for use with the Model 50 Teaching Aid.

REPORTS - Periodic reports on the progress and development of the Automated Teaching Aids Project include the following:

Progress Report No. 1 - The first of the progress reports on the Teaching Aids Project submitted to the Vocational Rehabilitation Administration, March 1963.

Programmed Learning in Vocational Training of Special Education Groups - A professional paper and an accompanying set of kodachrome slides presented at the annual convention of the American Psychological Association, Philadelphia, Pa., Aug. 1963.

Progress Report No. 2 - The second progress report on the development of the Automated Teaching Aids Project submitted to the Vocational Rehabilitation Administration, March 1964.

Auto-instructional Teaching Aids in Vocational Training and Rehabilitation of Mentally Retarded and Emotionally Disabled Adolescents - A professional paper and an accompanying set of kodachrome slides presented at the annual convention of the American Association on Mental Deficiency, Miami Beach, Florida, June 1965.

Research Report - Highlights of research findings obtained with selected teaching aid devices in field testing of sample programmed instructional materials developed in the Automated Teaching Aids Project and utilized with groups of mentally retarded and/or emotionally disabled teenagers, Dec. 1965.

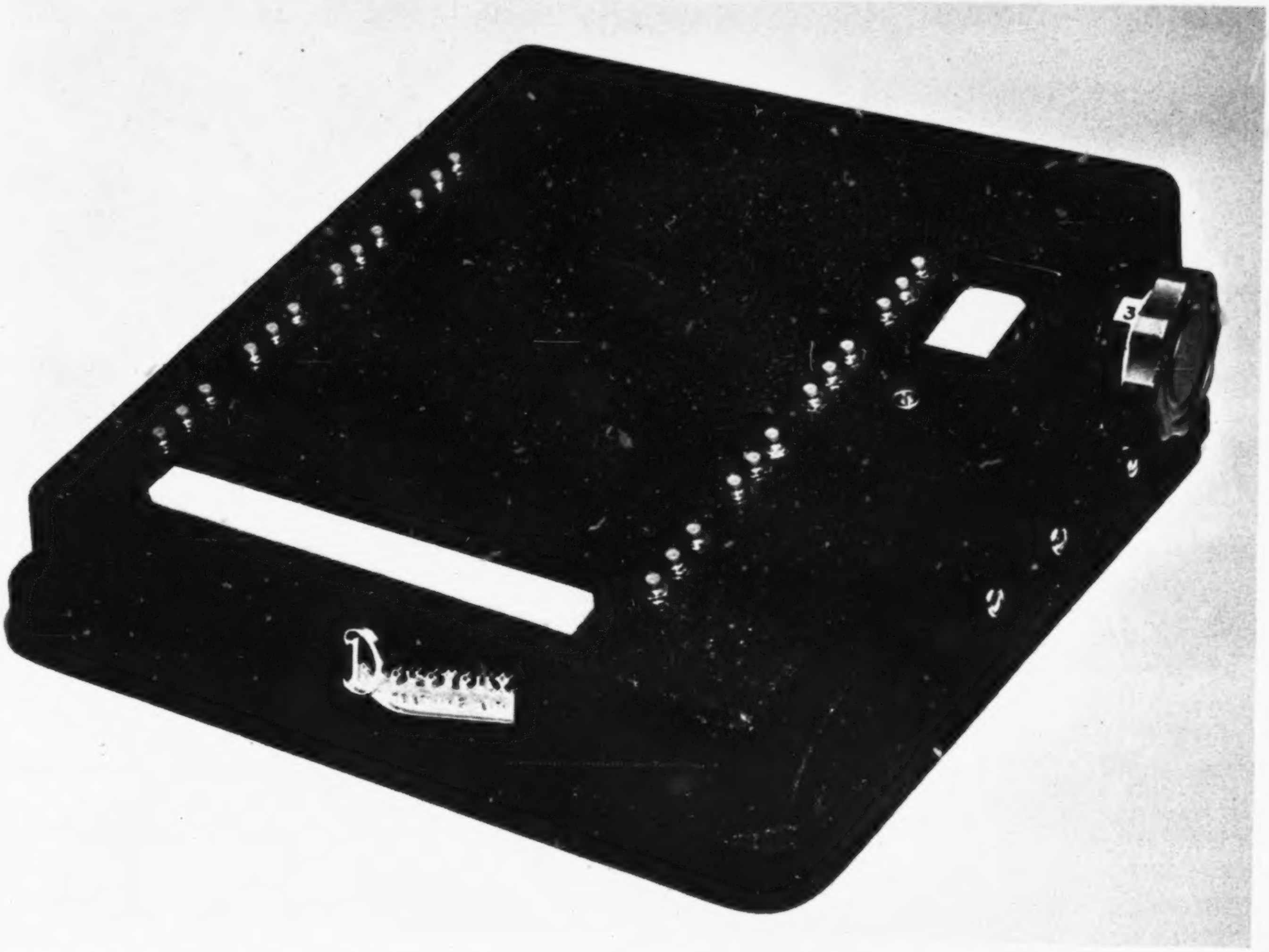
Final Report - A summary report on the VRA supported Automated Teaching Aids Project complete with descriptions of each of the five automated teaching aid devices and how they were used; a complete listing of the automated instructional materials developed during the course of the project; a summary of the research findings obtained in developmental and field testing of programmed material. The Final Report contains a number of illustrations, charts and sample pages of programmed instructional materials, Feb. 1966.

REPRINTS - Articles on topics related to the Teaching Aids Project published, or planned for publication, in professional journals:

Platt, H., Teaching machines and the mentally retarded, Rehabilitation Record, Sept., 1965.

Platt, H., Automated teaching aids in vocational training of mentally and emotionally handicapped adolescents. The Devereux Forum (publication pending)

EDUCATIONAL MATERIAL AVAILABLE FOR USE WITH THE MODEL 50 TEACHING AID



BULLETIN - How to Use the Devereux Model 50 Teaching Aid; Suggestions for Classroom Use

MANUAL - How to Prepare Programs for Use on the Devereux Model 50 Teaching Aid

WORKSHEETS - Sets of blank worksheets for use in preparing "frames" for Model 50 Teaching Aid programmed workbooks

SAMPLE WORKBOOK PAGES - Sample pages taken from programmed workbooks prepared for use on the Model 50 Teaching Aid

SAMPLE PROGRAM - Sample of programmed workbook used on the Model 50 Teaching Aid

MANUAL FOR FIELD TESTING - Suggestions for experimental use of the Model 50 Teaching Aid and accompanying programmed workbooks in developmental and field testing

INSTRUCTIONAL PROGRAMS - Programmed workbooks on several topics prepared for use on the Devereux Model 50 Teaching Aid:

You and Your Job (5 books)

- Part I - Abbreviations Used in Want Ads
- Part II - Job Responsibilities
  - Book 1 - Employment Terms
  - Book 2 - Importance of Job Responsibilities
  - Book 3 - Carrying Out Job Responsibilities
- Part III - Work Habits

Basic Arithmetic (18 books)

- Understanding Addition
  - Book I - Arithmetic Fundamentals; part A
  - Book II - Arithmetic Fundamentals; part B
- Understanding Subtraction
  - Book I - Fundamentals of Subtraction; part A
  - Book II - Fundamentals of Subtraction; part B
  - Book III - Advanced Concepts in Subtraction
- Understanding Multiplication
  - Book I - Basic Concepts in Multiplication
  - Book II - Reading Problems in Multiplication
  - Book III - Practice Problems in Multiplication
- Multiplication Combinations
- Understanding Division
  - Book I - Fundamentals of Division
  - Book II - Division of Large Numbers
  - Book III - Checking Long Division Problems
- Division Combinations
- Introduction to Fractions; Meaning and Vocabulary Terms
- Simple Fractions; Selecting the Larger or Smaller Number
- Understanding Decimal Fractions
- Addition and Subtraction of Decimals
  - Book I - Introduction to Add. and Subt. of Decimals
  - Book II - Practice Problems in Add. and Subt. of Decimals

Practical Arithmetic (8 books)

- Signs, Symbols and Abbreviations
- Practice Problems in Adding Money
- Practice Problems in Using Money
- Writing Money
- Coins and Making Change
  - Book I - Introduction and Coin Combination
  - Book II - Word Problems in Making Change
- Monetary Values
- Budgeting

Measuring (5 books)

- Vocabulary Used in Measuring
- The Measurement of Commodities

Measuring (continued)

- Linear Measurement
  - Book I - Recognition of units of measurements
  - Book II - Measuring with a Ruler
- Learning to Tell Time

Using the Telephone (10 workbooks)

- Book I - Basic Skills
- Book II - Dialing Practice
- Book III - Finding the Correct Number - Part 1
- Books IV & V - Finding the Correct Number - Parts 2 & 3 (white pages)
- Book VI - Finding the Correct Number - Parts 4a & 4b (yellow pages)
- Book VII - Planning a Call
- Books VIII & IX - Making a Call - Parts 1 & 2
- Book X - Receiving a Call

Home Nursing (12 books)

- Book I - Hand Washing
- Book II - The Coverall Apron
- Book III - The Back Rub
- Book IV - The Bed Bath
- Book V - Mouth Care
- Book VI - Bedmaking - Part 1; Importance of Good Bedmaking
- Book VII - Bedmaking - Part 2; Making an Unoccupied Bed
- Book VIII - Bedmaking - Part 3; Making an Occupied Bed
- Book IX - Making the Patient Comfortable in Bed
- Book X - Helping the Patient Out of Bed
- Book XI - Feeding the Patient
- Book XII - Washing Rubber Gloves

Homemaking and Family Living (18 books)

- Breakfast Table Setting

- Baby Sitting

- Home Safety (2 books)
  - Book I - Safety in the Kitchen
  - Book II - Safety in the Bathroom

- Care of Fabrics (3 books)
  - Book I - Laundering; Part a
  - Book II - Laundering; Part b
  - Book III - Laundering; Part c

- Hand Sewing Tools (5 books)
  - Book I - Cutting Tools and Pins
  - Book II - Measuring and Marking Tools
  - Book III - Needles

Hand Sewing Tools (Continued)

- Book IV - Threads and Needle Threading
- Book V - Pressing Tools

Sewing on a Button

Cleaning in the Home (5 books)

- Book I - Sweeping
- Book II - Dusting
- Book III - Vacuuming
- Book IV - Waxing
- Book V - Cleaning Glass Surfaces

Food Facts for the Kitchen (9 books)

Measuring Spoons

Measuring Cups

Cooking Ingredients (2 books)

- Book I - Dry Ingredients
- Book II - Liquid Ingredients

Cooking Terms Used in Recipes (3 books)

- Book I - Stirring, Mixing, etc.
- Book II - Cutting, Slicing, etc.
- Book III - Baking, Boiling, etc.

Reading a Recipe

Work Habits in the Kitchen

Using Tools (Tool Recognition - 6 workbooks)

Tool Recognition

- Book I
- Book II
- Book III
- Book IV
- Book V
- Book VI

Programmed "Tower System" Unit

Electronics Assembly, Test I

EDUCATIONAL MATERIAL AVAILABLE FOR USE WITH THE LEARN-EASE TEACHING AID

Devereux

LIFTING, CARRYING, AND LOWERING

A PROGRAMMED INSTRUCTIONAL WORKBOOK

THE DEVEREUX FOUNDATION
Institute for Research and Training
Devon, Pennsylvania 19333

BULLETIN - How to Use the Learn-Ease Teaching Aid; Suggestions for Classroom Use.

MANUAL - How to Prepare Programs for Use on the Learn-Ease Teaching Aid.

INSTRUCTIONAL PROGRAMS - Learn-Ease Programs Available for Use with the National Learn-Ease Teaching Device:

Lifting, Carrying, and Lowering

INSTRUCTIONAL PROGRAMS (Continued)

Using the Telephone (10 workbooks)

Book I - Basic Skills
Book II - Dialing Practice
Book III - Finding the Correct Number - Part 1
Book IV - Finding the Correct Number - Part 2 (white pages of
Book V - Finding the Correct Number - Part 3 telephone directory)
Book VI - Finding the Correct Number - (Yellow pages of directory)
Parts 4a and 4b
Book VII - Planning a Call
Book VIII - Making a Call - Part 1
Book IX - Making a Call - Part 2
Book X - Receiving a Call

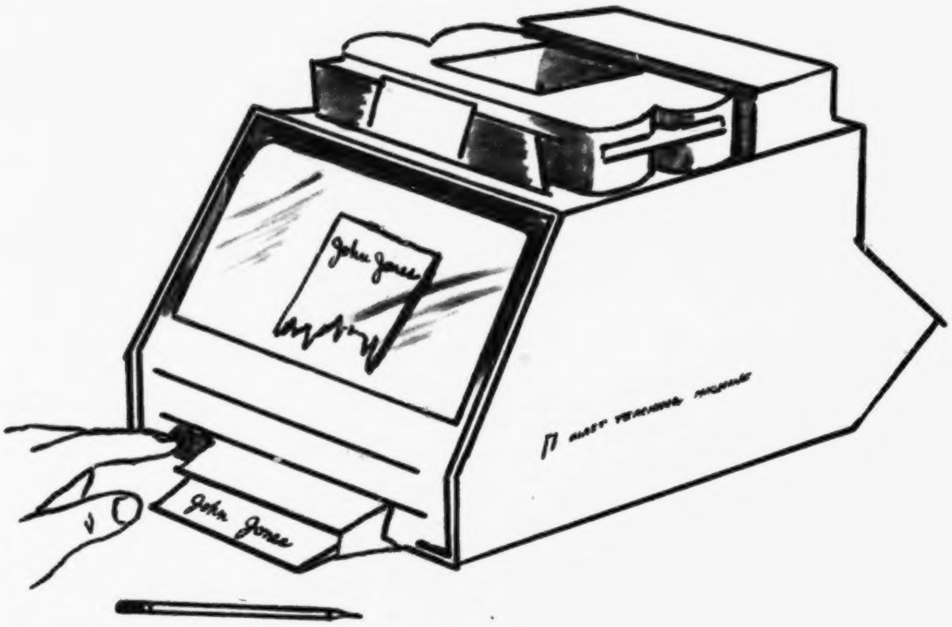
Home Nursing (12 books)

Book I - Hand Washing
Book II - The Coverall Apron
Book III - The Back Rub
Book IV - The Bed Bath
Book V - Mouth Care
Book VI - Bedmaking - Part 1; Importance of Good Bedmaking
Book VII - Bedmaking - Part 2; Making an Unoccupied Bed
Book VIII - Bedmaking - Part 3; Making an Occupied Bed
Book IX - Making the Patient Comfortable in Bed
Book X - Helping the Patient Out of Bed
Book XI - Feeding the Patient
Book XII - Washing Rubber Gloves

The Learn-Ease Program on Using the Telephone is adapted from similar content material developed for the programmed workbooks employed with the Devereux Model 50 Teaching Aid. Both the Learn-Ease and Model 50 programs were developed for use with the Teletrainer, a set of two telephones and a central control unit which is available on loan from most Bell Telephone Company Business Offices. The sample telephone directory, which accompanies both the Learn-Ease and Model 50 program on the telephone, is necessary for use with several workbooks which are utilized to provide practice in the use of the white and yellow pages of a telephone directory

The Learn-Ease Program on Home Nursing is adapted from similar content material prepared in the form of programmed workbooks for the Devereux Model 50 Teaching Aid. Upon completion of the Learn-Ease or Model 50 Program on Home Nursing, a Certificate in Home Nursing may be offered by the American Red Cross if the course is taught by a certified Red Cross instructor.

EDUCATIONAL MATERIAL AVAILABLE FOR USE WITH THE MAST TEACHING MACHINE



BULLETIN - How to Use the Mast Teaching Machine; Suggestions for Classroom Use.

MANUAL - How to Prepare Programs for the Mast Teaching Machine.

SAMPLE PROGRAM - An excerpt from a sample Mast Program on How to Cash a Pay Check

INSTRUCTIONAL PROGRAMS - Cartridge Programs available for use with Mast Teaching Machines:

Your Paycheck

Cartridge I	Lesson 1a:	Exchanging Work for Wages
	Lesson 1b:	What the Paycheck Looks Like
Cartridge II	Lesson 2:	How to Cash Paychecks
Cartridge III	Lesson 3:	Paycheck Deductions
Cartridge IV	Lesson 4:	Deductions for Income Tax
Cartridge V	Lesson 5:	Deductions for Social Security Tax

The Bank and Its Services

Cartridge VI	Lesson 1:	Checking and Savings Accounts
Cartridge VII	Lesson 2:	Lending and Borrowing Money

Social Security

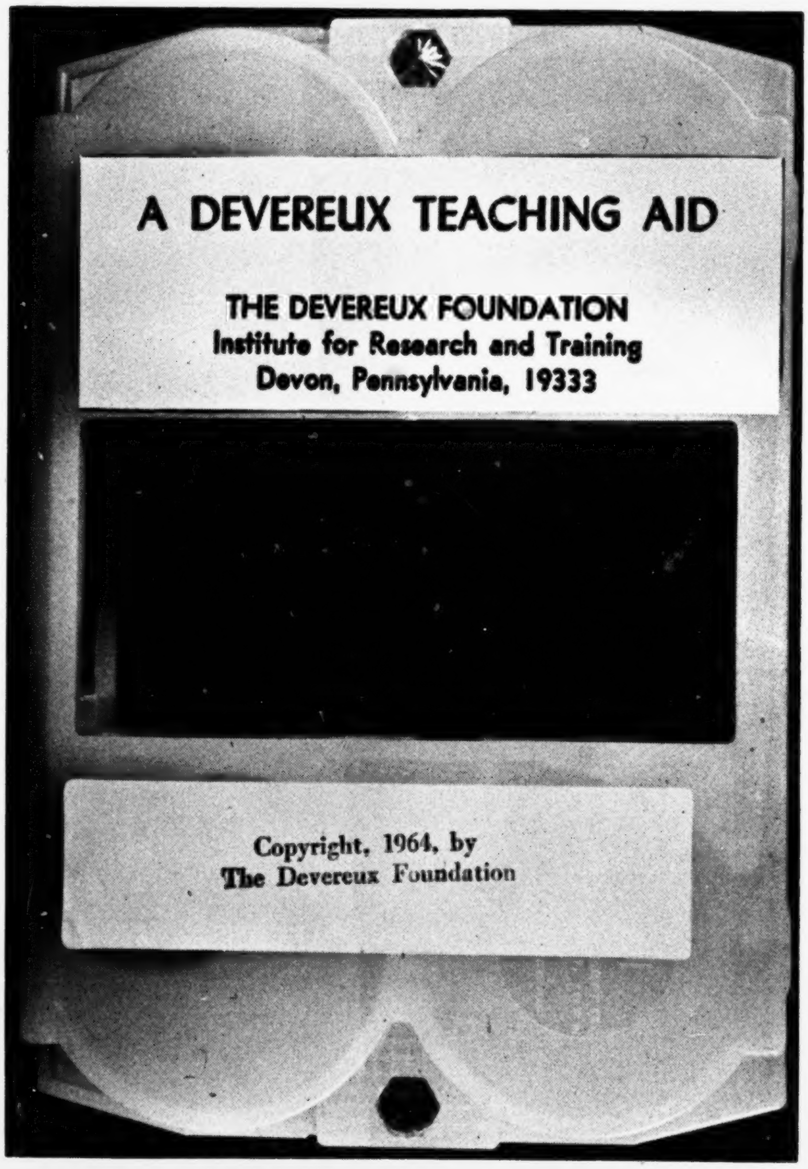
Cartridge VIII	Lesson 1:	Fundamentals of Social Security

Filling Out the Job Application Form

Cartridge IX	Lesson 1:	Personal Information
Cartridge X	Lesson 2:	Type of Position
	Lesson 3:	Previous Employment Record
	Lesson 4:	Educational Record
Cartridge XI	Lesson 5:	Personal References

Home Nursing

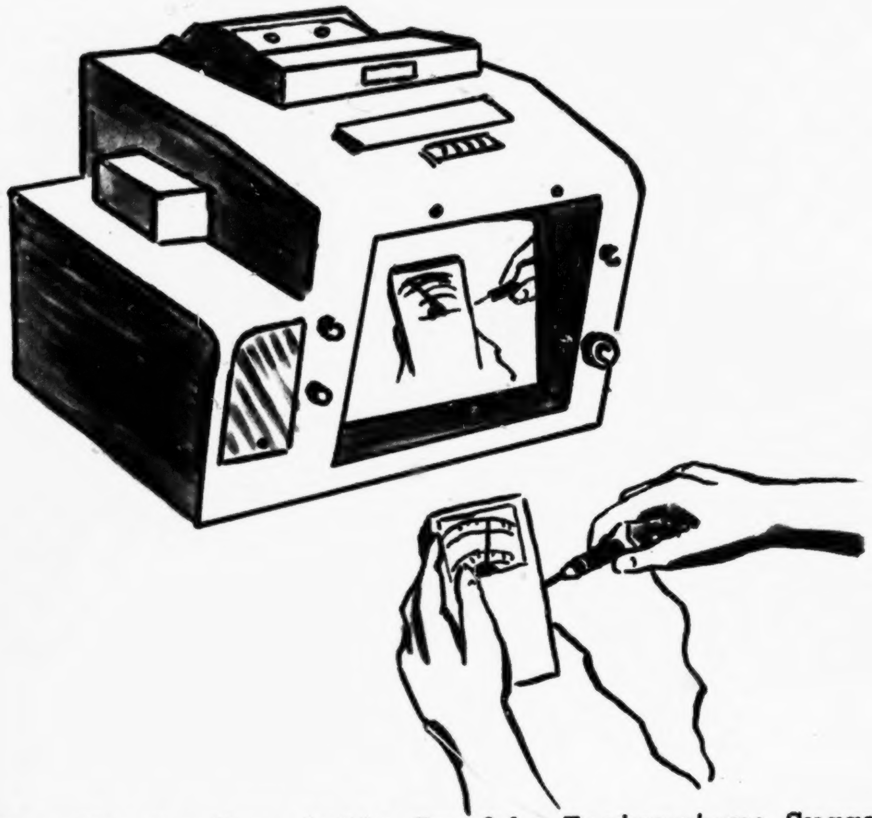
Cartridge XII	Lesson 1:	Hand Washing
	Lesson 2:	The Coverall Apron


A DEVEREUX TEACHING AID
THE DEVEREUX FOUNDATION
Institute for Research and Training
Devon, Pennsylvania, 19333
Copyright, 1964, by
The Devereux Foundation

Top view of Lesson Cartridge for Mast Teaching Machine

The Mast Teaching Machine may be purchased from the Mast Development Corporation, Davenport, Iowa.

EDUCATIONAL MATERIAL AVAILABLE FOR USE WITH THE GRAFLEX AUDIO-GRAPHIC INSTRUCTOR



BULLETIN - How to Use the Graflex Audio-Graphic Instructor; Suggestions for Classroom Use.

MANUAL - How to Prepare Programs for the Graflex Audio-Graphic Instructor

INSTRUCTIONAL PROGRAMS - Coordinated tapes and colored slides developed for Graflex Teaching Aid Programs:

Applying for a Job

Slide Tray I	Lesson 1a	- The First Impression; part 1
Slide Tray II	Lesson 1b	- The First Impression; part 2
	Lesson 2	- Arriving for the Interview
Slide Tray III	Lesson 3	- The Interview; part 1
	Lesson 4	- The Interview; part 2

How to File Income Tax, Form 1040A

Slide Tray I	Lesson 1 -	Filling Out the Front Part
Slide Tray II	Lesson 2 -	Filling Out the Back Part

How to Use a Cash Register

The Waitress

Measuring With A Ruler

Part 1: Measuring with the Inch
Part 2: Measuring with 1/4", 1/2", 3/4" Units
Part 3: Using the 1/16", 1/8" Units of Measurement

Programmed Lesson Units Related to the Tower System of Simulated Work Samples

Electronics Assembly Test

Slide Tray I	Test 1 - Learning the Color Code
	Test 2 - Following Blue Prints and Running Wires
	Test 3 - Inspecting the Job
	Test 4A - Tying the Knot Used in Lacing
Slide Tray II	Test 4B - Tying the Knot Used in Lacing
	Test 5 - Running a Cable Harness
	Test 6 - Inspecting the Job
Slide Tray III	Test 7 - Lacing
	Test 8 - Measuring and Cutting Wires
	Test 9 - Stripping Wires
	Test 10 - Tinning Wires

Leathergoods Test

Slide Tray I	Test 1 - Measuring With the Ruler
Slide Tray II	Test 2 - Drawing and Cutting Cardboard Rectangles
	Test 3 - Using Dividers to Mark Cardboard
Slide Tray III	Test 4 - Pasting
	Test 5 - Directions for Making a Frame
	Test 6 - Making a Frame
Slide Tray IV	Test 7 - Constructing a Pen and Pencil Tray
Slide Tray V	Test 8 - Using a Cutting Machine
	Test 9 - Making a Desk Blotter
Slide Tray VI	Test 10 - Making an Ashtray

How to Use a Drill Press

Slide Tray I	Lesson 1 - Introduction to the Drill Press
Slide Tray II	Lesson 2 - Capacity of the Drill Press

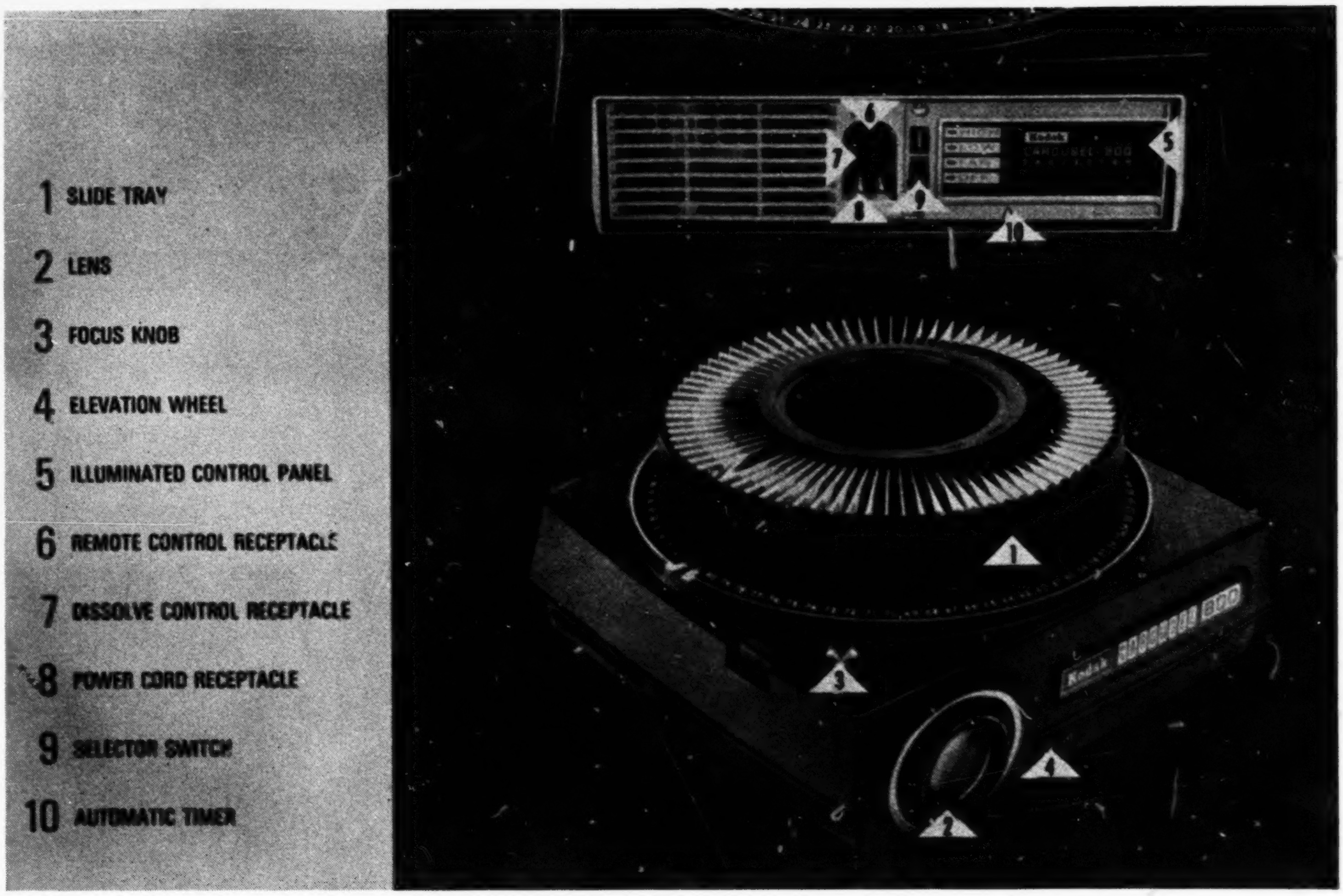
The Wood Turning Lathe

Slide Tray I	Lesson 1 - Introduction to the Wood Lathe
Slide Tray II	Lesson 2 - Wood Turning

Continuity Checks

The Graflex Audio-Graphic Instructor may be purchased from The Graflex Corporation, Rochester, New York.

THE CAR-TAP TEACHING AID


1 SLIDE TRAY
2 LENS
3 FOCUS KNOB
4 ELEVATION WHEEL
5 ILLUMINATED CONTROL PANEL
6 REMOTE CONTROL RECEPTACLE
7 DISSOLVE CONTROL RECEPTACLE
8 POWER CORD RECEPTACLE
9 SELECTOR SWITCH
10 AUTOMATIC TIMER
Kodak

THE RECORDING COMPONENTS OF THE CAROUSEL PROJECTOR

BULLETIN - How to Use the Car-Tap Teaching Aid; a leaflet describing the use of an Eastman Kodak Carousel Slide Projector and an ordinary tape recorder for simultaneous audio-visual presentation. The unit is an adaptation of the technique which utilizes the Graflex Audio-Graphic Instructor. The coordinated taped and slide program is similar to that employed with the Graflex but does not require a special tape cartridge and utilizes a regular take up reel for the tape.

The Kodak Carousel Projector and Programmer may be purchased from most local distributors of Eastman Kodak products. Further information on this equipment may be obtained from Eastman Kodak Co., Customer Service Division, Rochester, New York.

EDUCATIONAL MATERIAL AVAILABLE FOR USE WITH THE A-V-K TECHNIQUE

Utilizing the A-V-K Technique

BULLETIN - The A-V-K Technique; Suggestions for Classroom Use

MANUAL - How to Prepare Programs Utilizing the A-V-K Technique

INSTRUCTIONAL PROGRAMS - Coordinated tapes and graphic materials developed for A-V-K Programs. Each program is also available in a special adaptation utilizing transparencies for use on overhead projectors:

- Cook's Helper
- A Dishwasher
- Measuring in the Kitchen
- A Breakfast Setting
- Jobs in the Laundry
- A Gas Station Attendant

PROJECT SUMMARY AND RECOMMENDATIONS

General Background - The current emphasis on providing adequate schooling for all children highlights the need for special education, including individual remedial instruction and vocational training for the mentally retarded, the emotionally disabled and disadvantaged youth in general. Although the need is great, limited instructional material is available for use in vocational training and rehabilitation of adolescents who are: (a) slow learners, but not markedly mentally retarded, and (b) the emotionally handicapped; those with emotional and/or personality disorders, presently severe enough to necessitate their removal from the regular classroom because of the learning and/or personal adjustment problems they present. These two groups, while different, do seem to present enough common elements so that it would appear feasible to develop vocational training material for both groups concurrently.

Project Background - Exploratory studies conducted at The Devereux Schools utilizing an experimental teaching aid, the Devereux Model 50, and programmed instructional workbooks prepared for use on this teaching device, showed sufficient promise to warrant more extensive development and research. These early findings suggested that a coordinated plan of classroom teaching and programmed instruction offers a dynamic and challenging opportunity for service to these disability groups. Both the "slow" learner and the poorly motivated "reluctant" learner, responded favorably to classroom instruction supplemented by automated instructional techniques and showed more academic gain from the experience than was obtained in the classroom utilizing only the conventional teaching methods.

From these beginnings, the Devereux Foundation Institute for Research and Training, with support from the Vocational Rehabilitation Administration, embarked on the current three-year project on automation in vocational training of mentally retarded and emotionally disabled youth. These disability groups have responded well to auto-instructional techniques that are used to supplement and enrich the work in the classroom, to reinforce concepts covered in class and to make the instructional material more exciting and meaningful.

Scope of Project - The project was primarily concerned with the preparation, development and refinement of programmed material in vocational and work-related areas for use with the Devereux Model 50 Teaching Aid and other auto-instructional teaching aids that are readily available throughout the country. A secondary goal encompassed evaluation of the effectiveness of using programmed instruction in vocational training of adolescents with moderate intellectual and/or emotional handicaps.

While in overall purpose the project was research-oriented, efforts were heavily concentrated on the development of automated instructional units in pre-vocational training areas related to the "world of work," i.e., job responsibilities, job finding, etc., and in some specific vocational areas, i.e., tool recognition, shop measurement, homemaking, etc. The decision to devote considerable time to work-related program materials was heavily influenced by the many requests that were received for such material from special education and rehabilitation personnel. These inquiries highlighted the need for providing mentally and emotionally handicapped youth with basic occupational information and practice, concurrent with vocational training, in order to enhance selective job placement, i.e., understanding work terms, knowing how to use the telephone, how to make change, etc.

Early Plans and Development - Considerable effort was spent in recruiting and in training of "programmers," in establishing physical facilities to carry on the work encompassed in the project and in exploring subject areas for programming. During the early stages of the project, efforts were concentrated on adapting the Devereux Model 50 Teaching Aid to the needs of the project; also, to the preparation, development and refinement of a series of programmed workbooks in a variety of subject areas for use on this eaching device. Consideration was also given to exploring the use of other readily available auto-instructional devices that could be adapted to the project, in addition to the Model 50.

Efforts were made to encourage teachers to use their own ingenuity and creativity in preparing programmed lesson units in areas of their own interest. A series of instructional manuals were prepared by members of the project staff giving helpful suggestions for preparing programmed instructional materials for use on each of the automated teaching aids employed in the project. Manuals of instruction for classroom use of the teaching devices were also prepared and made available to teachers.

As the project developed, consideration was given to exploring and lining up field settings and to evaluation of student populations for experimental use of the programmed instructional materials under development. An on-going program of developmental studies and field tests provided an opportunity for collection, analysis and evaluation of data and for later revision and final refinement of the prepared programmed units; more comprehensive research was conducted in later field tests.

Some time was spent in exploring the possibility of enlisting the interest of industrial concerns and professional organizations to publish the final editions of the prepared programmed materials so that they could be made available free or at low cost to schools and institutions serving the mentally retarded and emotionally handicapped.

Throughout the course of the project, members of the staff shared highlights of the project with professional groups; lectures and demonstrations included findings obtained in developmental and in field testing and were encompassed in graphically illustrated programs at annual meetings and conventions of national professional organizations.

Preparation of Programmed Materials - The Devereux Model 50 Teaching Aid, because of its ease of operation and upkeep, and the economy afforded in its use was planned as the basic source of presentation. Other teaching devices were considered, however, when it appeared that the areas under study could best be presented through an audio-visual presentation that employed other types of auto-instructional devices along with, or in lieu of, the Model 50 presentation.

In general, the lesson units follow the Skinner-Pressey technique of linear programming; the material is presented in small sequential steps - there is gradual step-by-step development of a point through the utilization of cueing, repetition and reinforcement. The Model 50 programmed workbooks are geared to the slow learner who functions on a 4th-5th grade reading level. The Devereux Readability Index was employed in the programming of these workbooks. The programmed units prepared for the various auto-instructional devices utilized in the project, are intended to complement regular teaching methods and not to replace them. They are planned to serve as self-contained units that present new study material, develop concepts, and provide practice for reinforcement of learning to stabilize concepts already covered in class. A specially devised apparatus, the Model 50 Response Recorder, was used in an item analysis to identify frames that might cause undue difficulty in Model 50 programs. Programs were developed for use with the following five types of auto-instructional devices:

1. The Devereux Model 50 Teaching Aid - A light-weight, compact, teaching device, made of cast aluminum, which measures 12" x 12" x 4", weighs only 12 pounds, and utilizes a standard six-volt battery as its only source of current. It is designed for use with specially prepared workbooks, 7" x 11" in size, which utilize a multiple-choice format. The amount of reading in some topics can be limited to as few as one dozen words per page. The programmed workbook rests on the flat, inclined surface of the teaching device, between two rows of push buttons, which are arranged in groups of three and correspond to three multiple-choice answers to each item on the page. The student responds to each item by pushing down the button next to the answer he chooses. Correctness of response is verified immediately by a light in the upper right hand corner. Some of the programs developed for use on the Model 50 Teaching Aid include:"Practical Arithmetic," "Measuring," "Tool Recognition," "Using the Telephone," "Home Nursing," and "Homemaking and Family Living."

2. The Learn-Ease Teaching Device - A slide-mask programmed learning device which is essentially a 12" x 10" vinyl portfolio, weighing less than two pounds and employing a simple "masking" technique. Learn-Ease programs utilize a multiple-choice format and are adapted from those prepared for the Model 50 Teaching Aid. However, they are self-contained and do not require the use of the Model 50. A sliding mask on the right side of the unit covers the workbook page and reveals or covers each "frame." The student reads a question and records his answer; he then slides the mask down the page to uncover the correct answer and compares it with his own response. Programming for the Learn-Ease is like that for the Model 50 and provides immediate reinforcement for correct answers and on-the-spot correction of wrong responses. Programs on "Home Nursing," "Use of the Telephone," and one on industrial safety called "Lifting, Carrying and Lowering" have been prepared for use on this teaching device.

3. The Mast Teaching Machine - A small, compact, photo-optical teaching aid which weighs 11 pounds and is electrically operated. The programmed lesson units are presented on microfilm which is housed in a special plastic cartridge and projected on to a 4" x 6" self-contained rear projection screen. The student views and responds to only one "frame" at a time and writes the answer to each question in the space provided. He then presses a button to reveal the correct answer and his own answer slides under a transparent shield so he can't change it. He compares his answer with the correct one and immediately learns whether it is right. If it is wrong, he writes in the correct answer. Pressing down on another button advances the next frame. Several programs in work-related areas have been developed and are designed to provide an orientation to the "world of work." These include: "Filling Out a Job Application Form," "Your Paycheck," "Social Security." The programs have been used with the 'teenage school "underachiever."

4. The Graflex Audio-Graphic Instructor - A teaching device which projects 35mm color transparencies on to a rear vision screen to the accompaniment of a taped commentary. Impulses are recorded on the magnetic tape for automatic slide changes. The student controls the instructional pace, stops the audio portion to study the pictures and follows the simple spoken directions on the tape to carry out various assigned tasks. He knows at once whether a response is appropriate and errors can be corrected before they become habitual.

   The Graflex is particularly useful in teaching slow learners with limited reading ability who are able to follow simple, verbal directions. It is helpful in teaching job operations which require manipulation and physical activity as well as in teaching work-related topics. Some of the available Graflex programs are: "Applying for a Job," "Measuring With a Ruler," "The Waitress," "How to Use a Drill Press."

The Car-Tap Unit - A teaching device which is essentially an adaptation of the Graflex programming technique, employs an Eastman Kodak Carousel Slide Projector and a common tape recorder. Since this technique evolved just prior to the termination of the project there was no opportunity to prepare programs specifically for use with this teaching device.

5. The A-V-K Unit - An opaque or an overhead projector set-up which utilizes a coordinated taped program and makes use of multi-sensory stimuli. The technique for presentation is a group procedure which resembles a small language laboratory and accommodates six students and one instructor. Auditory stimulation is furnished by a pre-recorded lesson; visual stimulation comes from the projected drawings or pictures related to the topic under study; kinesthetic stimulation is provided through the student's manipulation of "props" as directed by the taped commentary.

   The A-V-K programs are especially useful with the more retarded students handicapped by poor reading ability. Programs related to unskilled job information include: "The Cook's Helper," "The Dishwasher," "Jobs in the Laundry."

Publications and Programmed Material - A summary listing of the publications and programmed instructional material prepared during the course of the project is given in Section XIII, and encompasses the following 27 bulletins and manuals:

Information Booklet - 1
Catalogues of Prepared Material - 2
Reports - 6
Reprints - 2
Manuals for Model 50 Teaching Aid - 6
Manuals for Learn-Ease - 2
Manuals for Mast Machine - 3
Manuals for Graflex Instructor - 2
Manual for Car-Tap Unit - 1
Manuals for A-V-K Unit - 2

A series of 157 programmed lesson units prepared for use on the five types of auto-instructional devices employed in the project included the following:

92 units - Model 50 Teaching Aid
23 units - Learn-Ease
12 units - Mast Machine
24 units - Graflex Instructor
6 units - A-V-K unit

Two basic manuals of instruction were prepared for use with each of the automated instructional aids employed in the project; a "How to Use" instruction pamphlet was planned and developed for use as a guide to making the most effective use in the classroom, of the teaching devices utilized in the project. The other, a pamphlet on "How to Prepare Programs," was planned to serve as a step-by-step guide to preparation of programmed instructional materials for use on each type of teaching aid under study.

The Student Population - In general, a group of mentally retarded and a group of emotionally handicapped adolescent boys and girls, in residence at The Devereux Schools in Pennsylvania, ranging in age from 12 to 20 years, and in the 70-90 I.Q. range, were utilized in the developmental and field testing of the programmed instructional material. Comparable groups of mentally and emotionally handicapped students were drawn from the vocational and special education classes of several nearby state and private institutions and from local public schools.

Research Highlights covered: (a) findings obtained in preliminary field testing of programmed instructional material developed for use with most of the auto-instructional aids, and (2) later field testing of Model 50 programmed instructional material.

Four different teaching methods were employed in studies designed to evaluate the effectiveness of utilizing the prepared programmed instructional material in vocational training of mentally retarded and/or emotionally disturbed adolescents:

1. Automated Method where the teacher function is to guide student use of the auto-instructional device. No formal classroom lesson was taught and prepared programmed instructional material made up the course content.

2. Conventional Method of teacher instruction using proven approaches of lecture, discussion, etc. No use is made of auto-instructional devices.

3. Integrated procedure wherein the teacher utilizes auto-instructional devices with programmed material in addition to employing proven teaching approaches.

4. Programmed Lecture approach which deviates from conventional procedures through teacher use of prepared lecture materials that follow the same sequential steps and content outlined in the programmed instructional units.

Four auto-instructional devices were used in the field studies and included (1) the Devereux Model 50 Teaching Aid, (2) the Mast Teaching Machine, (3) the Graflex Audio-Graphic Instructor, and (4) the A-V-K Technique. During the course of field testing two additional automated teaching devices were developed- the Learn-Ease Teaching Aid and the Car-Tap Technique; time did not permit their use in the field studies.

The basic experimental design, for the most part, included a comparison of the effect of utilizing the four described teaching techniques in presenting vocational training material to the group of mentally retarded or emotionally handicapped adolescents comprising the population of this study. In most cases equated groups made up of students from Devereux Schools and from other residential settings and public school special education classes were employed in the studies. There was no intent to pit the teacher against the machine and the focus was on how to enhance the learning atmosphere through use of programmed instructional material.

Several preliminary field tests were conducted utilizing programmed instructional lesson units prepared for use on the indicated automated teaching devices, as for example, Model 50 programs which involved the development of skills in such work-related areas as filling out of job applications and in applying for a job. Two of the study programs were prepared for use on the Mast Teaching Machine; another study on "Applying For a Job," used a programmed lesson unit prepared for use on the Graflex. A study involving "Measurement in the Kitchen," utilized the A-V-K Technique. Later field testing concentrated on the Model 50 Teaching Aid and the programmed units under study included: "Job Responsibilities,", "Tool Recognition," "How to Use the Telephone," and instruction in an American Red Cross course in "Home Nursing." Arrangements were made for a certificate to be awarded by the American Red Cross to those students who successfully complete the course.

Statistical treatment of the data included among other procedures, simple and complex analysis of variance designs and one and two tailed "t" tests. The statistical procedures were employed to determine if differences existed in the acquisition of instructional material between the four teaching approaches as measured by achievement and/or performance tests. The findings obtained in the studies and the implications are discussed in detail in Sections IX and X.

In general, the obtained findings indicated that students in the experimental group, who had the benefit of programmed instruction showed greater retention of the prepared lesson material, as measured on pre and post-tests, when compared to accomplishments of those students taught along conventional lines. Perhaps of greater significance, from the standpoint of the population studied, was the fact that the experimental group of students later showed more ease and greater proficiency in handling simulated or actual applied work situations.

Conclusions and Implications - Six major findings emerged in analysis of the data obtained in the studies evaluating the effectiveness of utilizing programmed instruction in vocational training of the mentally and emotionally handicapped adolescent included in the population under study:

1. The automated teaching method which used prepared programmed instructional materials was in most cases more efficient than the conventional and the programmed lecture methods, when gains were measured by achievement test scores.

2. Of the four experimental teaching methods used in the studies, the integrated method, which utilized programmed instructional aids to reinforce and help stabilize concepts introduced by the teacher in the classroom, proved to be more effective in enabling students to transfer and to utilize learned material in a practical work situation.

3. Students who were taught by the machine method alone, demonstrated the weakest performance on proficiency tests.

4. There was a reduction in time required by the students to learn material presented in the classroom, when auto-instructional aids were introduced into the learning situation.

5. Students demonstrated better ability to remember what they had learned, as measured by retention tests, when programmed instructional material was used in the learning situation.

6. Students using auto-instructional aids, taken as a group, demonstrated a higher achievement and performance level on the criterion instruments than those students who did not have the benefit of these instructional aids; there is, however, considerable variation within each group in the attained individual scores, despite the teaching method employed.

It is recognized that automated instruction, as such, cannot replace the need for well-equipped vocational training facilities. Also, it cannot take the place of resourceful, dedicated and inspiring teachers whose personal enthusiasm and interest in the student is so important. It is felt, however, that automated instructional aids can be developed for use in vocational evaluation and training of the mentally retarded and the emotionally disabled adolescent.

The studies suggest that the training of mentally retarded and emotionally handicapped adolescents for applied practical work situations can be enhanced through a coordinated program of good teaching supplemented by programmed instruction. When properly integrated, programmed instruction may enrich the vocational training program by: helping to stabilize learned concepts and to reinforce learning; allowing the teacher to provide more individual attention to students who need such support; providing self-pacing in the learning process for the slow and "reluctant" learner; generally helping to enhance the performance level of intellectually disadvantaged youth.

The development of instructional material focusing upon work related activities would seem to serve a real need for these disability groups and should prove to be a useful adjunct to vocational training programs which focus on more specific occupational areas. The findings of the studies suggest programmed instruction can be beneficial in providing the student with an orientation to, and preparation for, taking his place in the vocational world, and is worthy of further exploration.

It is hoped that the shared experiences of this report will serve to provide others with suggestions for initiating and developing their own programs for the mental retardate and other special education and disability groups, and that they in turn will also share their experiences with others in this challenging endeavor.

RECOMMENDATIONS

1. Although results obtained with prepared programmed units on work-related activities have been most encouraging, further development is needed to meet the increased demands of changing employment practices. All too often, the mentally retarded youth may possess vocational skills but is unwilling or unable to obtain employment because of difficulties in job-related areas, i.e., filling out a job application. Further problems may arise on the job if he is unable to understand employment terms, use the telephone, make change, etc. Ongoing development of and related research on work-related material should be considered to keep pace with the times.

2. Consideration should be given to further evaluation of programmed instructional materials adapted from the Model 50 workbooks for use on the Learn-Ease Teaching Aid. The Learn-Ease is lighter, easier to handle and to house, and less expensive to purchase and to maintain. Comparative studies should be made between findings obtained in use of programmed material prepared for use on both teaching aids in order to determine the effectiveness of the Learn-Ease as a teaching aid in contrast to the Model 50; positive findings may have bearing on its use by institutions with limited budgets.

3. Comparative research between the Graflex and the Car-Tap unit should be undertaken to evaluate their effectiveness in programmed instruction. The Car-Tap is an adaptation of the technique employed with the Graflex; the required equipment is more readily available to schools and institutions than the Graflex Audio-Graphic Instructor. It is less expensive, requires little maintenance and can be serviced locally at reasonable cost. Since the Car-Tap technique evolved just prior to termination of the project, time did not permit further study and experimentation with the equipment. It is felt that the Graflex programmed units can easily be adapted for use on this unit.

4. Evaluation of the sample programmed instructional units related to the TOWER system of simulated work samples that were prepared for use on the Graflex Audio-Graphic Instructor (Section VI-8) suggests that this method of presentation has value both as a method of assessment and as a training device. It is recommended that further research be undertaken: (a) to determine the effectiveness of this technique when utilized in comprehensive diagnostic vocational appraisals; (b) to explore the possibility of programming additional tests in the TOWER series which would appear to lend themselves to an automated method of presentation.

5. Consideration should be given to adaptation of the auto-instructional devices for use with stroke and accident patients. It would appear that specially prepared programmed instructional material could prove useful in the vocational rehabilitation of this group of patients. This instructional media would provide an opportunity for patients of these disability groups to re-learn material previously retained as well as to provide them with an opportunity for new learning at their own pace; the programmed material would also be useful for review of instructional material to stabilize concepts and to reinforce learning.

   A major problem in the development of programmed instructional material for the vocational re-education of stroke and accident patients would be in the need to produce programs for the patients at different ability levels within the specific disability groups. Consideration would have to be given to development of a variety of programmed materials in order to provide learning experiences for persons presenting different disabilities, interests and aptitudes who may require retraining in job related activities suitable for a variety of work settings. Programmed instruction could serve a very real need in allowing these patients to work independently and assume a more direct role in their own rehabilitation; this approach may prove to be especially useful when the patient is not physically able to engage in an active work program.

6. It is suggested that further consideration be given to contacts with industrial organizations and with national professional groups to explore the possibility of such groups assuming the sponsorship for reproduction of the programmed materials developed in this project so that it can be made available free or at low cost to organizations working with the mentally retarded.

   For example, the programmed instructional material which was developed for use in a course on Home Nursing, has received official approval by the American Red Cross. Under American Red Cross sponsorship, special education classes in the public schools of Milwaukee, Wisconsin, are currently testing the effectiveness of this material, using the Learn-Ease Teaching Device. There has been contact with the American Telephone and Telegraph Company and there is a possibility that it may adapt and standardize both the Model 50 and the Learn-Ease versions of How to Use the Telephone so that these could be provided on a loan basis free of charge, to special education classes in the public schools. Similar sponsorship of existing programmed materials or for development of new, should be encouraged.

7. An area of further development might be to demonstrate to industrial organizations and professional groups how programmed instructional material can be of value in the vocational training of the retarded to a point of effective employment. From this, it would be hoped that new employment possibilities would develop and that the employers would assume the responsibility for developing programmed instructional material specific to their requirements.

8. Greater attention should be paid to individual differences in terms of which teaching method is best suited for what student. It is clear from analyzing individual differences between members of the same group, that some students gain at a high level and some do significantly poorer from pre to post testing; the same is likely true for teachers as well. Some teachers can adapt and effectively utilize auto-instructional devices without fanfare, whereas in other cases, the teacher may be unable to adjust to the new technique for a variety of reasons; this is a worthwhile area for further exploration.

9. Continued attention should be given to refinement of the presently available "How to Do It" series of instruction manuals developed during the course of the project to enhance their use by teachers preparing programmed instructional units in specific subject content areas.

Fitting Instructional Aids into the Teaching Schedule - In classroom observation of teachers cooperating in the project, no one method was noted in use of the automated teaching aids which seemed best suited for all classroom situations.

The following general suggestions give an idea of the way in which automated instruction may be integrated into the classroom schedule, as worked out by these teachers.

1. The automated teaching devices may be used in the classroom either with a small group, or for individual instruction depending, of course, on the type of teaching aid, the content of the program, and the ability level of the students.

2. The teaching aids may be kept on empty desks in a corner of the classroom or stored in a closet or on a shelf in the classroom, and carried to the student's desk when they are to be used.

3. A teaching device, like the Graflex Audio-Graphic Instructor, should be placed preferably in a corner toward the rear of the classroom with the screen facing away from the class. In this position, only the student who actually uses the machine will be able to see the pictures; he can also control the sound.

4. Certain automated instructional programs prepared for use on the Graflex Teaching Device could be presented to small classes of students by hooking up the Graflex to a remote control slide projector.

5. The Learn-Ease Teaching Device, because its format and size lends itself for the purpose, could be kept inside student desks along with the regular text books and be readily available for use, as indicated.

6. The teacher could present subject matter in the regular classroom routine and make use of the Learn-Ease on an individual basis, thus enabling the student to review the ideas presented in the classroom presentation and to reinforce and stabilize the central concepts which were covered.

7. The Learn-Ease, as well as other teaching devices which lend themselves for the purpose, could be used by students who have advanced beyond the rest of the class in certain areas, thus enabling the teacher to concentrate efforts on those students who are underachieving.

8. Teaching aids like the Model 50, could be used:

a. According to a Schedule - with each student receiving two or three opportunities per week to use them; for example, one student could work half a period with the teaching aid and then pass it on to another student when his time is up.

b. In their free time - rather than on an assigned schedule

c. Either according to a schedule or in their free time, as indicated by the measured reading and performance levels of the students, the type of teaching aid employed and the nature of their programmed instructional units.

Obviously, a great deal depends upon the ingenuity of the teacher and her concern that the teaching aids should be utilized in the most effective way appropriate to the institutional settings, the scope of the instructional programs, and the capabilities of the students. Exploration of these factors should be an on-going process.

Sharing Information - An on-going program of sharing highlights of the project was maintained during the course of the project and is described in Section XII. Members of the project staff presented lectures, showed the auto-instructional devices under study and demonstrated the programmed instructional material prepared for use on these teaching devices at various professional meetings such as AAMD, APA, and APGA.

A complete set of the 157 programmed units, the 27 instructional and related manuals, reports and reprints, and a set of 3 albums of graphic material such as photos, sample slides and pamphlets are being furnished to the Vocational Rehabilitation Administration. A duplicate set of this material will be maintained at the Devereux Foundation Institute for Research and Training. A complete set of programmed lesson units prepared for use on the Model 50 Teaching Aid and a complete set of the instructional manuals for use with the Model 50 and with the other auto-instructional aids are on deposit at the Clinton P. McCord Library of the Devereux Foundation, Devon, Pa.

Copies of the publications and programmed materials have been distributed to individuals and institutions cooperating in the project. The Model 50 Teaching Aid is now available for purchase through the Devereux Foundation Department of Publications, which will also have available copies of the manual related to its use in the classroom as well as the instructional manual on "How to Prepare Model 50 Programs." As indicated by interest and demand, copies of the Model 50 programs developed in the project will be reproduced and made available at low cost.

Presentation of Final Report - The highlights of the material contained in the Final Report, including the research findings, will be presented by members of the Project Staff at the annual convention of the American Association on Mental Deficiency in Chicago, Illinois, May 1966. Copies of the Final Report will be distributed to a selected mailing list of individuals and organizations that expressed an active interest in the project. Copies of the Final Report are available from the Devereux Foundation, Department of Publications, Devon, Pa.

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APPENDIX A

A FEW TERMS USED IN PROGRAMMED INSTRUCTION

Adjunct Auto-Instruction: a system where the teacher used automated instructional devices to supplement lecture and for testing purposes. This system was developed by S.L. Pressey at the Ohio State University.

Answer Construct: a technique in linear programming (see linear programming) where the student writes in, or constructs his answer to a fill-in type question.

Auto-Instructional Methods: a comprehensive term used to describe instruction which is characterized by the controlled presentation of material, the elicitation of correct responses, and control of the way in which learning proceeds. Sometimes used synonymously with the term programmed learning.

Automated Method: an instruction system where students use auto-instructional devices with the teacher present to supervise and encourage continuance in the program. No formal classroom presentation is made by the teacher.

Branching: a programming method which presents several answers to a question following a paragraph. The student selects an answer. If he is incorrect, he "branches" off to a review paragraph which has remedial properties before proceeding to the next item. If his answer is right, he proceeds directly to the next item.

Confirmation: the teaching machine confirms the correctness of the student's response by means of some signal. It is this confirmation which reinforces a correct response.

Conventional Method: an instructional approach which follows traditional methods of teacher presentation such as lecture, discussion, and demonstration. No auto-instructional devices are employed.

Cue: an aspect of an item which helps a student to answer a question correctly.

Differential Reinforcement: refers to a procedure where one response is reinforced but another, sometimes similar one, is not.

Error Rate: refers to the number or percentage of a given group of students incorrectly responding to a specific item on the program. A high degree of error indicates the need for revision.

Integrated Method: an instructional approach where the teacher used auto-instructional devices to supplement regular classroom presentation.

Intrinsic Programming: a method of presenting programmed materials which was introduced by Norman Crowder. The technique uses a multiple-choice question answer sequence following subject matter paragraphs. Branching is an important part of the system. (see branching.)

Item or Frame: a small paragraph of information which calls for the response from the student. An item may contain one or more sentences.

Linear Programming: a program which presents information in one logical sequence of development. Every student goes through the same material. Professor B. F. Skinner is associated with this method.

Multiple Choice: a technique used by both Pressey and Crowder where questions concerning program frames, items, or paragraphs are presented with alternative answers, which the learner must choose from. The student does not construct his own answer.

Pacing: the rate at which a student is permited to work through the programmed material.

Program: a sequence of items leading the student to mastery of the subject with minimal error. Information is given to the student in small units to which he responds in some way - by completing a sentence, working a problem, or answering a question.

Programmed Lecture Method: an instructional approach similar to conventional classroom presentation. The major distinction, however, is this method employs a lecture method where materials are broken down into small behavioral steps and presented in a graduated manner. The outline followed is the same as with usual programmed materials. No auto-instructional devices are employed.

Prompting: the method or sequence of providing verbal and symbolic cues to encourage responses. Can be visual, verbal, symbolic or auditory.

Reinforcement: any stimulus which increases the probability that the immediately preceding response will be given again under similar circumstances. This is what is said to occur when the student sees the correct answer after he has made the correct response. Because it is reinforced, this correct response is more likely to occur in the future, i.e., it is learned.

Self-Pacing: the rate at which a student might complete the materials at his own speed, depending upon the success he has had with previous steps.

Shaping Behavior: refers to attempting to change behavior by reinforcing specific behaviors and gradually raising the criteria for reinforcement of those responses.

Step: the distance or interval from one frame to the next. (see item.)

Successive Approximations: a comprehensive term which refers to: reinforcing responses which are improvements over previous ones of the same category; gradually raising the steps for reinforcement to occur.

Terminal Behavior: the new response patterns which the program is written to establish.

APPENDIX B

SAMPLE ACHIEVEMENT TEST

NAME: ______________________________ Date:______________ Age:_________

HOME NURSING

DIRECTIONS: This test is made up of sixty-two questions on home nursing. Next to each question there are four answers. You are to pick out the correct answer and circle the letter beside it with pencil.

Example X

The home nurse takes care of

a. the visitors
b. the patient
c. the dishwashing
d. the floor sweeping

In EXAMPLE X "b" is the correct answer
Circle the letter in pencil.

Example Y

The patient is

a. a sick person
b. a zoo keeper
c. a race car driver
d. a funny person

In EXAMPLE Y "a" is the correct answer
Circle the letter in pencil.

If you wish to change your answer, be sure to erase completely and mark your new answer clearly.

You are not expected to know all the answers. Try to answer even when you are not sure.

1. When leaving the sick room, the coverall apron should be

   a. washed
   b. hung up
   c. taken with you
   d. put in the waste basket

2. The coverall apron is used

   a. to keep clean
   b. by the doctor
   c. to prevent the spread of disease germs
   d. by the patient

3. The coverall apron must be tied

   a. at the back and shoulders
   b. at the arms and legs
   c. at the neck and waist
   d. all of the above

4. After putting the coverall apron on and before caring for the patient you

    a. wash your hands
    b. ask the patient if he is comfortable
    c. prepare the bed bath
    d. wait five minutes

5. The most important reason for washing your hands is to

    a. remove dirt
    b. reduce disease germs
    c. make the patient comfortable
    d. keep fingernails clean

6. Hands are washed using

    a. hot water
    b. alcohol
    c. hot water and soap
    d. cool water and soap

7. When you wash you hands, you should wash

    a. under your fingernails
    b. your wrists
    c. your fingers
    d. all of the above

8. The home nurse should wash her hands

    a. before and after caring for the patient
    b. before going to work every morning
    c. before feeding the patient
    d. all of the above

9. After washing you hands with soap, you should first

    a. wipe them
    b. tell the head nurse
    c. use hand lotion
    d. rinse them

10. Rubbing alcohol is used for back rubs because it makes the back

    a. slippery
    b. clean
    c. hurt
    d. warm

11. When giving a back rub make sure the patient does not become

    a. ill
    b. too warm
    c. chilled
    d. sore

12. In giving a back rub, pressure should be

    a. firm
    b. light
    c. hard
    d. none of the above

13. After the back rub, the home nurse uses

    a. warm towels
    b. talcum powder
    c. alcohol
    d. medicine

14. Before giving a back rub, the home nurse's fingernails should be

    a. cut short
    b. filed
    c. polished
    d. dipped in alcohol

15. Before giving a back rub, the home nurse should wash her hands in

    a. cool water
    b. hot water
    c. alcohol
    d. none of the above

16. Plastic gloves are used for procedures which are

    a. healthy
    b. bloody
    c. clean
    d. sterile

17. After washing and before turning surgical gloves inside out you should wait

    a. one hour
    b. one day
    c. two days
    d. none of the above

18. The first step in washing surgical gloves is

    a. scrub them with a brush
    b. put them in soapy water
    c. rinse them in hot water
    d. rinse them in cold water

19. After rubber gloves have been washed and dried, they are ready to be

    a. used again
    b. put away in a dry place
    c. sterilized
    d. all of the above

20. The patient's food tray goes on the

    a. foot of the bed
    b. bedside table
    c. nearest chair
    d. patient's chest

21. When eating, it may be easier for the patient to use

    a. a knife
    b. a spoon
    c. a fork
    d. his fingers

22. Before the patient starts to eat, the backrest should be

    a. lowered
    b. raised
    c. removed
    d. none of the above

23. The patient should be fed

    a. a large amount of food
    b. a small amount of food
    c. a variety of food
    d. a plateful of food

24. The brown material that collects in the mouths of sick people is called

    a. varnish
    b. sordes
    c. dentine
    d. oral paste

25. The times the patient brushes his teeth, the basin should be removed after the patient has

    a. wet his toothbrush
    b. rinsed his mouth
    c. dried his chin
    d. brushed his teeth

26. The toothbrush could be

    a. wet with water
    b. wet with mouthwash
    c. used with toothpaste
    d. all of the above

27. When a patient brushes his teeth he should put a towel

    a. under his chin
    b. behind his head
    c. on his lap
    d. he should not use a towel

28. While giving a bed bath a towel is placed under the patient's head to

a. keep him warm
b. protect the bedding
c. dry the head and neck
d. keep the sheet free from hair

29. Before giving a bed bath you should

a. wash your hands
b. check the patient's temperature
c. change the patient's bed sheets
d. change the patient's bed gown

30. The patient is kept warm during the bed bath by

a. using a hot towel
b. using warm clean sheets
c. using a bath blanket
d. using a bath gown

31. While giving a bed bath, soap is not used

a. on the face
b. on the neck
c. on both of the above
d. on either of the above

32. The stroke used to rinse and dry the patient's face is

a. an S stroke
b. a C stroke
c. a gentle stroke
d. a fast stroke

33. The patient's feet are washed

a. in a bowl
b. in a pitcher
c. in a basin
d. none of the above

34. In order to keep bedding dry, place towels

a. under the patient
b. under the bedding
c. on the home nurse
d. on the blankets

35. A bed that is well made is free of

a. bumps in the bed
b. wrinkles on the bed
c. neither of the above
d. both of the above

36. Bed aores can be caused by

  a. bumps in the bed
  b. wrinkles in the bed
  c. dirty sheets on the bed
  d. blanket itch

37. A nice looking room

  a. makes the home nurse's work easier
  b. adds to the patient's comfort
  c. cures the patient
  d. makes visitors want to see the patient

38. Protecting and caring for medical equipment is an important duty of

  a. the doctor
  b. the patient
  c. the janitor
  d. the home nurse

39. All the duties of the home nurse are done

  a. to earn a raise in pay
  b. to get a promotion
  c. to keep the patient safe and comfortable
  d. to keep from getting fired

40. The most important reason for good bed making is

  a. to keep busy
  b. to make your boss happy
  c. to protect the sheets from soilage
  d. to protect the mattress

41. A well made bed not only makes the patient comfortable but also protects

  a. pillows from being wet and soiled
  b. mattress from being wet and soiled
  c. sheets from being wet and soiled
  d. blankets from being wet and soiled

42. The draw sheet can be made of

  a. rubber
  b. cotton
  c. plastic
  d. all of the above

43. The top or bottom edge of the sheet is called

  a. the hem
  b. the fold
  c. the shield
  d. the cast

44. The sheets at the head of the bed should be tucked in

a. loosely
b. tightly
c. slowly
d. should not be tucked in

45. The blanket should be far enough up towards the head of the bed

a. to cover the patient's chest
b. to cover the patient's shoulders
c. to cover the patient's neck
d. to cover the patient's face

46. A bed with a patient in it is called

a. an occupied bed
b. a reserved bed
c. a full bed
d. a heavy bed

47. The soiled pillow case should be removed

a. by pulling it off straight with a fast stroke
b. by turning it inside out
c. by shaking the pillow out
d. none of the above

48. In bed making, the type of corners you make using the top sheet are

a. round corners
b. square corners
c. flat corners
d. broad corners

49. The blanket should be

a. tucked in at the foot of the bed
b. tucked in on the sides of the bed
c. tucked in on both the foot and sides of the bed
d. should not be tucked in

50. In order to make the patient comfortable in bed, the nurse supports different parts of the patients body with

a. wads of cotton
b. pillows
c. blankets
d. sheets

51. A folded towel can be used to support the patient's

a. shoulders
b. knees
c. feet
d. none of the above

52. When you help the patient out of bed

  a. you stant in front of the patient
  b. you stant behind the patient
  c. you stand at the side of the patient
  d. you stand above the patient

53. When the weak patient gets out of bed he will have to place his hands on your

  a. hands
  b. shoulders
  c. arms
  d. waist

54. When you sidestep with the patient you must support him

  a. under his armpits
  b. under his hands
  c. by holding his waist
  d. by holding his arms

55. To help a patient return to a high bed use

  a. a blanket
  b. a chair
  c. a stool
  d. all of the above

56. Attractive surroundings

  a. make the home nurse's work easier
  b. add to the patient's comfort
  c. cures the patient
  d. makes visitors want to see the patient

57. The home nurse's duty is first

  a. to the head nurse
  b. to the patient
  c. to the patient's visitors
  d. to herself

58. People who can be made sick from disease germs are

  a. patients
  b. the home nurse
  c. the doctor
  d. all of the above

59. Blood is washed off rubber gloves first with

  a. hot water
  b. cold water
  c. boiling water
  d. rubbing alcohol

60. The patient is well enough to get up when

a. he is feeling better
b. the doctor decides it
c. he has been in bed one week
d. he has taken medicine

61. Leverage is the same as

a. balance
b. comfort
c. lifting power
d. nose spray

62. A pillow placed under the patient's shoulder (for support of the upper arm and hand) will prevent strain on the

a. upper arm
b. back
c. neck
d. shoulder joint

APPENDIX C

STUDENT PERCEPTION FORM PROGRAMMED INSTRUCTION

NAME:____Date:____________AGE:_______

DIRECTIONS: This inventory is made up of seven statements. Next to each statement there are three responses. Circle the response that comes closest to the way you feel about the statement.

Example X

1. I like

a. mashed potatoes
b. baked potatoes
c. I don't like potatoes

In example X there is no one correct answer. The right answer is the one you feel is right.

Example Y

2. I believe most books are

a. easy
b. hard
c. some are easy, some are hard

In example Y there is no correct answer. The right answer is the one you feel is right.

If you wish to change your answer, be sure to erase completely and mark your new answer clearly.

1. I would rather be taught by

a. a teacher
b. a teaching machine
c. both teacher and teaching machine

2. I believe students in other classes learned

a. more than my class did
b. less than my class did
c. as much as my class did

3. I believe I learned

a. as much as other people in my class
b. less than other people in my class
c. more than other people in my class

4. I believe I learned

a. more than people in other classes
b. as much as people in other classes
c. less than people in other classes

5. I would like

a. to stay in my same class
b. to be in another class
c. not to have this class

6. I would like to learn more about

   a. home nursing
   b. something different from home nursing
   c. I don't want to learn about anything

7. I feel I

   a. liked the class on home nursing
   b. did not like the class on home nursing
   c. didn't mind the class but didn't like it either

APPENDIX D

PROGRAMMED INSTRUCTION ATTITUTE SURVEY (PIAS)

DIRECTIONS: Circle the words under each of the statements below which best show how you feel about that statement.

EXAMPLE: I LIKE ROCK AND ROLL.

Strongly Agree   Agree   Disagree   Strongly Disagree

If you like rock and roll very much, you would circle Strongly Agree like this:

I LIKE ROCK AND ROLL

[✓ Strongly Agree]   Agree   Disagree   Strongly Disagree

If you like rock and roll a little bit, you would circle Agree like this:

I LIKE ROCK AND ROLL

Strongly Agree   [✓ Agree]   Disagree   Strongly Disagree

If you dislike rock and roll a little bit, you would circle Disagree like this:

I LIKE ROCK AND ROLL

Strongly Agree   Agree   [✓ Disagree]   Strongly Disagree

If you dislike rock and roll very much, you would circle Strongly Disagree like this:

I LIKE ROCK AND ROLL

Strongly Agree   Agree   Disagree   [✓ Strongly Disagree]

Read each sentence on the next page and circle the words that show how you feel about that sentence. Remember, if you

Like very much	circle Strongly Agree
Like a little	circle Agree
Dislike little	circle Disagree
Dislike very much	circle Strongly Disagree

1. I became more interested in Home Nursing because of the teaching machine.

   Strongly Agree   Agree   Disagree   Strongly Disagree

2. I would like to use the teaching machines more often.

   Strongly Agree   Agree   Disagree   Strongly Disagree

3. I would rather have a teaching machine to help me learn than a teacher.

   Strongly Agree   Agree   Disagree   Strongly Disagree

4. I need less help in my work because of the teaching machine.

   Strongly Agree   Agree   Disagree   Strongly Disagree

5. I like to work with teaching machines.

   Strongly Agree   Agree   Disagree   Strongly Disagree

6. I understood things taught by the teaching machine.

   Strongly Agree   Agree   Disagree   Strongly Disagree

7. My class was taught in a new way.

   Strongly Agree   Agree   Disagree   Strongly Disagree